PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

PMM

DESIGN • MANUFACTURE • FINISHING • USE

No. 3 in a Series . . .
This advertisement originally appeared in September, 1948.

. . . they're still coming to Monarch and they still marvel at what they see!

He came to look
. . but he stayed to marvel!
Meet Sherlock Holmes . . . modern style.
He's one of thousands of successful business men who, facing a tough production problem, must find a sound, practical solution at prices that are fair to buyer and seller alike. Here's how he found what he was looking for.
At Monarch, in one progressive organization, he found intelligent product design and engineering . . . 35 years of casting "know-how" . . . 300,000 square feet of company-owned facilities offering every modern mechanical device for the production, inspection and shipment of quality aluminum permanent mold, aluminum die cast and zinc die cast parts and finished products.
Put yourself in this picture. Consider the extent to which these services and facilities can lighten your burden of production planning and accomplishment. Then ask yourself this simple question . . "Isn't Monarch the answer to our problem of doing our job quicker, better . . . and with greater profit?" We'll rest our case on your decision.
3 casting methods in 1 modern plant
ALUMINUM PERMANENT MOLD
ALUMINUM DIE CASTING
ZINC DIE CASTING
For Quality
Monarcast
MONARCH ALUMINUM MFG. COMPANY • DETROIT AVENUE AT WEST 93rd STREET • CLEVELAND 2, OHIO

. . . because Monarch's services and Monarch's casting facilities meet industry's most exacting requirements!

There's much more to buying castings today than just placing the order.

That's why Monarch's "production package" is so important . . . why these outstanding services and facilities are so widely relied upon by leading companies in many industries. Here's what you'll find in Monarch's "production package":

- Completely integrated facilities for mass production of quality-controlled aluminum permanent mold castings, high pressure aluminum and certified zinc die castings.
- Complete product finishing.
- Complete product assembly.
- Experimental development facilities.
- Specially trained personnel to provide practical solutions for your most complex casting problems.
- The valuable experience gained in 39 years of productive service to industry.

We invite you to look into Monarch's "production package". Then, as we said in our September, 1948 advertisement . . .
"We'll rest our case on your decision."

MONARCH ALUMINUM MFG. COMPANY • *Detroit Avenue at W. 93rd Street • Cleveland 2, Ohio*

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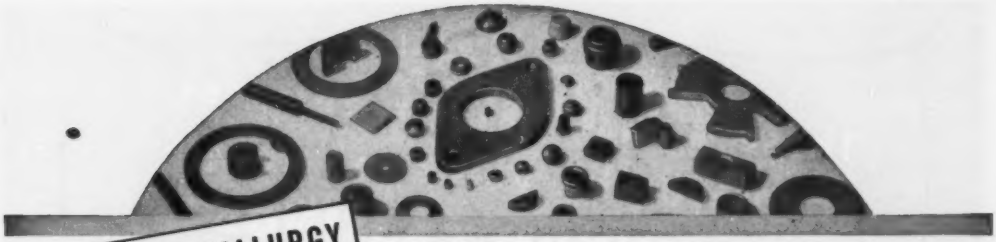

POWDER METALLURGY
the modern method
of manufacturing

KUX PRESSES

THE MACHINES
UNIVERSALLY USED

POWDER METALLURGY is the process being chosen for the manufacture of many products because of the cost savings produced from this automatic, high speed production method. Parts such as porous, self-lubricating bearings, carbon brushes, and insulators, Alnico magnets, carbide tool bits, magnetic radio cores, contact buttons, gears, cams and literally thousands of other items are accurately and automatically made with unbelievable cost savings on Kux Presses.

BUILDERS of the most complete line of machines available for this industry, Kux Presses have been selected by all the leading manufacturers for the superiority in design and construction built into every model. A penny post card will bring you detailed information and an illustrated catalogue.

KUX MACHINE COMPANY
6725 N. RIDGE • CHICAGO 26, ILLINOIS

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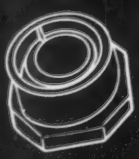
These PERMITE Services guard the value of your ALUMINUM CASTINGS for Defense Production

***DESIGN** — Recommendations made by Permite engineers for structural design changes based on the casting process, casting size, complexities or other factors, often bring the customer worthwhile savings and better casting performance.

***PRODUCTION** — Over 30 years of experience in working with aluminum and its alloys are behind the skill and "know how" of our metallurgists, engineers and foundry personnel.

***QUALITY** — Spectrographic analysis, X-ray inspection, Zyglo black light inspection, combined with other advanced inspection and quality control procedures guarantee the quality of Permite Castings.

***DELIVERY** — Permite's modern plants with a monthly capacity of over 2,500,000 lbs. of aluminum alloy castings, and ample warehouse facilities favorably located for shipping, assure delivery of your castings when you need them.



PERMITE

Write for Bulletin 20-A describing Permite complete facilities for serving your aluminum castings requirements. Send blueprints for recommendations and estimates.

ALUMINUM INDUSTRIES, INC.

CINCINNATI 25, OHIO

DETROIT: 809 New Center Building. NEW YORK: 9 Rockefeller Plaza. CHICAGO: 64 E. Jackson Boulevard. ATLANTA: 413 Grant Building.

ALUMINUM PERMANENT MOLD, SAND and DIE CASTINGS...HARDENED, GROUND and FORGED STEEL PARTS

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APRIL 1952
Vol. 10 No. 4

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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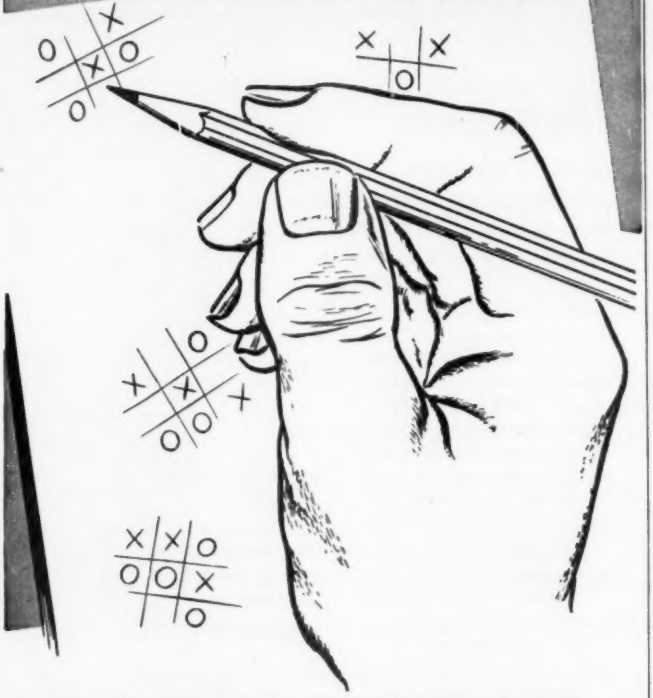
Are You Puzzled?



Yes, die castings are different. It takes more than machines to produce die castings.

Die Castings are Newton-New Haven's business. Here is an organization that has production and engineering talent to help you with your die casting problems.

Newton-New Haven has prepared a booklet on "Dimensioning Die Castings." This is basic data that every Engineer and Designer should have. Write on your company letterhead for your copy.

NEWTON NEW HAVEN

THE NEWTON-NEW HAVEN COMPANY

689 THIRD AVENUE • WEST HAVEN 16 • CONNECTICUT

LETTERS TO THE EDITOR

FROZEN MERCURY CASTINGS

We note that in the January issue, an article appeared on the frozen mercury type castings.

We would appreciate you sending us a copy of this article.—J. R. B.

Forwarded.—Ed.

ELECTROMAGNETIC PUMP FOR ALUMINUM

One of our customers has sent us an enquiry for a furnace, obviously a type of holding furnace with an electromagnetic pump for pumping molten aluminum to the die-casting machine.

We have not heard of any such equipment; however, as our customer has informed us that American manufacturers produce this type of thing we feel sure that you, as publishers, should have the names of specialists in this line at your disposal. We shall be greatly obliged if you can kindly put us in touch with the manufacturers of the above-mentioned equipment.—M. B. (Norway).

Information forwarded.—Ed.

continued on page 6

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You're always right with AUTO-LITE Die Castings

● Many of America's leading manufacturers, producing a wide variety of products, are benefiting from Auto-Lite die cast research, experience and advancement. Such developments as high pressure casting, special alloying practices and improved quality through the "controlled metals process" make Auto-Lite the logical source of supply for precision die castings. Address inquiries to:

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Lockland Division, Cincinnati 15, Ohio

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Chicago 5, Illinois

723 New Center Bldg.
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DIES like THESE

are Produced by Men with Experience and Quality Machines at

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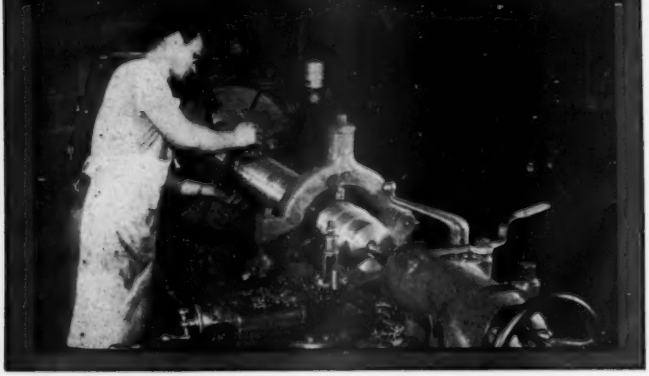
PERMANENT MOLDS AND CORES • TUBULAR DIES
EXTRUSION DIES • DIE CASTING DIES

Staffed by specialists with many years of experience PMD is ready and equipped to meet your exacting specifications for highest quality and most intricate dies.

Serving Industry Throughout the United States and Canada. PMD Customers Include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries.

PERMANENT MOLD DIE COMPANY, INC.

A COMPLETE DIE DESIGN SERVICE AVAILABLE



LETTERS TO THE EDITOR
continued from page 4

DIE CASTER'S TRADEMARK

I am interested in finding the manufacturer of a zinc die cast brass-plated handle for a bathroom faucet. The only indication of the source of this handle is a marking (sketch enclosed) on the underside of the handle.

If you have a record of the various trademarks of die casters and could tell me whose trademark this is, I would appreciate it immensely.

Is there any way I could obtain a list of the zinc die casters' trademarks and the corresponding manufacturers?—R. A.

The only source we know of for trademarks of die casters is a listing of members of the American Die Casting Institute. Although this includes a large number of major die casting firms, it is still far from a complete listing of the die casting facilities in this country.

We have checked the ADCI list but do not find the trademark you have submitted (the letters CSM in a circle).—Ed.

DIE CAST KNOBS

Occasionally we have requirements for a small quantity of metal knobs approximately 2½" to 3" shaft or with provisions for attaching to a shaft. These knobs should be decorative in appearance similar to those used on small power bench saws.

Will you, if possible, send me a list of manufacturers that die cast these knobs as standard items.—C.M.

It is not common practice in the die casting industry as it is in plastic molding to produce knobs and handles from stock dies. In most cases, dies are owned by the customer and are not available for production of stock items.—Ed.

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FAYETTEVILLE, N. Y.

In War or Peace *depend on* DIE CASTINGS from PRECISION's *7 Completely Equipped* PLANTS

In defense and civil production, there is increasing need for lighter, stronger, exactly accurate products and components at lower cost. The answer is *Precision Die Castings*—durable, dependable, designed to solve your production problems by the foremost engineering skill in the die casting industry.

Call a PRECISION Engineer *today!*

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MAGNESIUM PLANT

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ALUMINUM DIE CASTING ALLOYS

Aluminum alloys produced under quality controlled methods are specially designed to meet your die cast, permanent mold, or sand casting requirements.

For prompt dependable deliveries of quality aluminum in any quantity, write to

Aluminum Smelting & Refining Co., Inc

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You're Sure of Quality and Service

ZINC BASE DIE CAST ALLOYS

ZAMAK

Complete facilities plus modern production methods enable you to get high quality laboratory controlled zinc alloy to your exact specifications. Users of CERTIFIED receive prompt and dependable service for their requirements.

Certified Alloys Co.

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BEDFORD, OHIO

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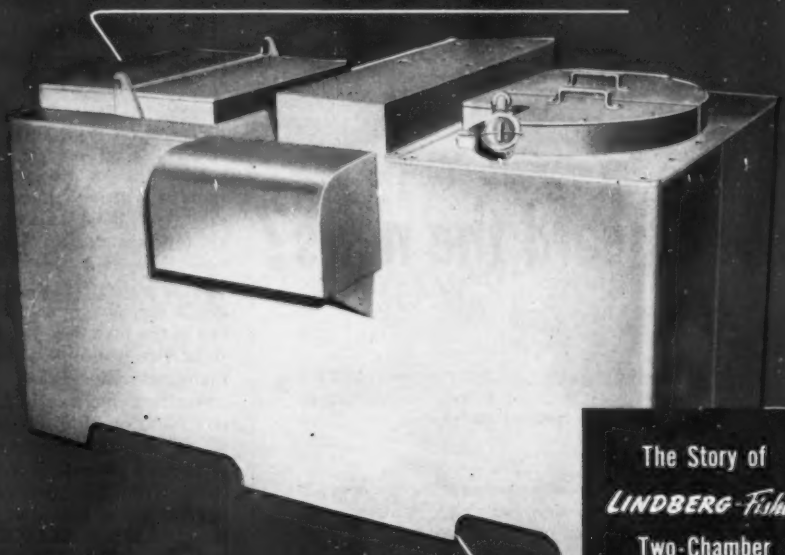

The Story of LINDBERG-Fisher Two-Chamber Induction Melting Furnaces

Get your copy of Bulletin 360. It tells how Lindberg-Fisher two-chamber construction combines the functions of melting and holding furnaces:

- permits charging cold metal without disturbing temperature conditions in ladling or pouring chamber.
- confines impurities to the charging chamber.
- eliminates channel clogging with "Channel Flushing".
- minimizes metal losses because the metal is heated from the inside out.
- assures clean, homogeneous metal.

Hundreds of Lindberg-Fisher two-chamber induction melting furnaces are in use in all parts of the world. There's a reason . . . and it's worth investigating. Ask for a copy of bulletin 360. Use this coupon.

LINDBERG-Fisher
Lindberg Engineering Company
2463 W. Hubbard St., Chicago 12, Ill.

Lindberg-Fisher Div.
Lindberg Engineering Co.
2463 West Hubbard Street
Chicago, Illinois

Please send me a copy of your new 12-page bulletin, "Lindberg-Fisher two-chamber induction melting furnaces".

Name _____ Title _____

Company _____

Street _____

City _____

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have you heard the news?

Plunger Slick

The first die casting plunger lubricant that really does the job — developed by G. W. Smith & Sons, Inc., creators of Die Slick, the industry's standard die lubricant.

Problem Solver

Here is a lubricant that casting temperatures cannot break down. It stays on the plunger and plunger chamber walls and lubricates all the time.

Prevents Sticking

Plunger Slick will not "build up" on plunger or cylinder walls — plungers never stick or score.

Production Saver

Plunger Slick cannot stain castings or injure surface finish. Plunger Slick protects both plunger and cylinder walls from corrosive "eating" effect of molten aluminum. Result, less down-time.

Proven Solution

Several of the largest die casters have proved that Plunger Slick solves all plunger lubrication problems.

Promptly Sent

We want you to try Plunger Slick in your own plant. Write for a trial gallon today.

P.S. Plunger-Slick, Protect-o-Metal and Die-Slick are made only by G.W. Smith + sons!

PLUNGER SLICK

G. W. SMITH & SONS, INC. 5403 KEMP RD., DAYTON, OHIO

sole importer for Great Britain — W. H. Hooker, Ltd., 4 Midland Crescent, Finchley Road, London N. W. 3

PAGE 10 *For additional information circle No. 81 on the Reader Service Card*

PROMOTIONS AND APPOINTMENTS

WALLACE A. DOEPEL to assistant sales manager of the *Arthur B. Colton Co.*, Div. of Snyder Tool & Engineering Co., Detroit, Mich.

Changes in executive positions at *Watson-Stillman* in Roselle, N. J., have been announced as follows: R. S. SWEENEY, vice president and treasurer elected a director; J. W. WEST, JR., a director, appointed assistant to the president; A. B. DISS, to be vice president in charge of manufacturing; R. W. DINZL, consulting engineer; ADOLPH deMATTEO, chief engineer; R. W. SCHRECK, general manager of sales; Hydraulic Div.; JACKSON KEMPER, general manager of sales, Distributor Products Div.; H. E. ELLIOTT, sales manager; J. P. BITTENBINDER, sales manager, Distributor Products Div.; W. R. BIEDERMANN, industrial engineer; ELSWORTH FALKENBERG, plant manager; ERIC NELSON, plant superintendent; A. WALTERS, production manager, Hydraulic Div.

ROBERT F. TIGHE, product manager, and DONALD M. WALKER, assistant product manager, pig and ingot products in the Chicago office of *Kaiser Aluminum & Chemical Sales, Inc.* Other Kaiser appointments announced include: JOHN M. WELCH as manager of the Chicago district sales office, J. A. KEENAN, JR. as branch representative in the Rochester sales office, and FREDERICK C. JONES as branch representative in the Minneapolis sales office.

ROBERT C. KLIENDINST as sales representative of *The Dollin Corp.*, producers of zinc and aluminum die castings, in the New York State (excepting metropolitan New York) and Northern Pennsylvania areas.

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

ENGINEERING SERVICE AVAILABLE

Crucible engineers and metallurgists are available to assist you in solving your design or production problems by the application of these Accumet Precision Investment Castings . . . that are playing such an important part in our National Defense Program.

CRUCIBLE

52 years of Fine steelmaking

first name in special purpose steels

ACCUMET PRECISION CASTINGS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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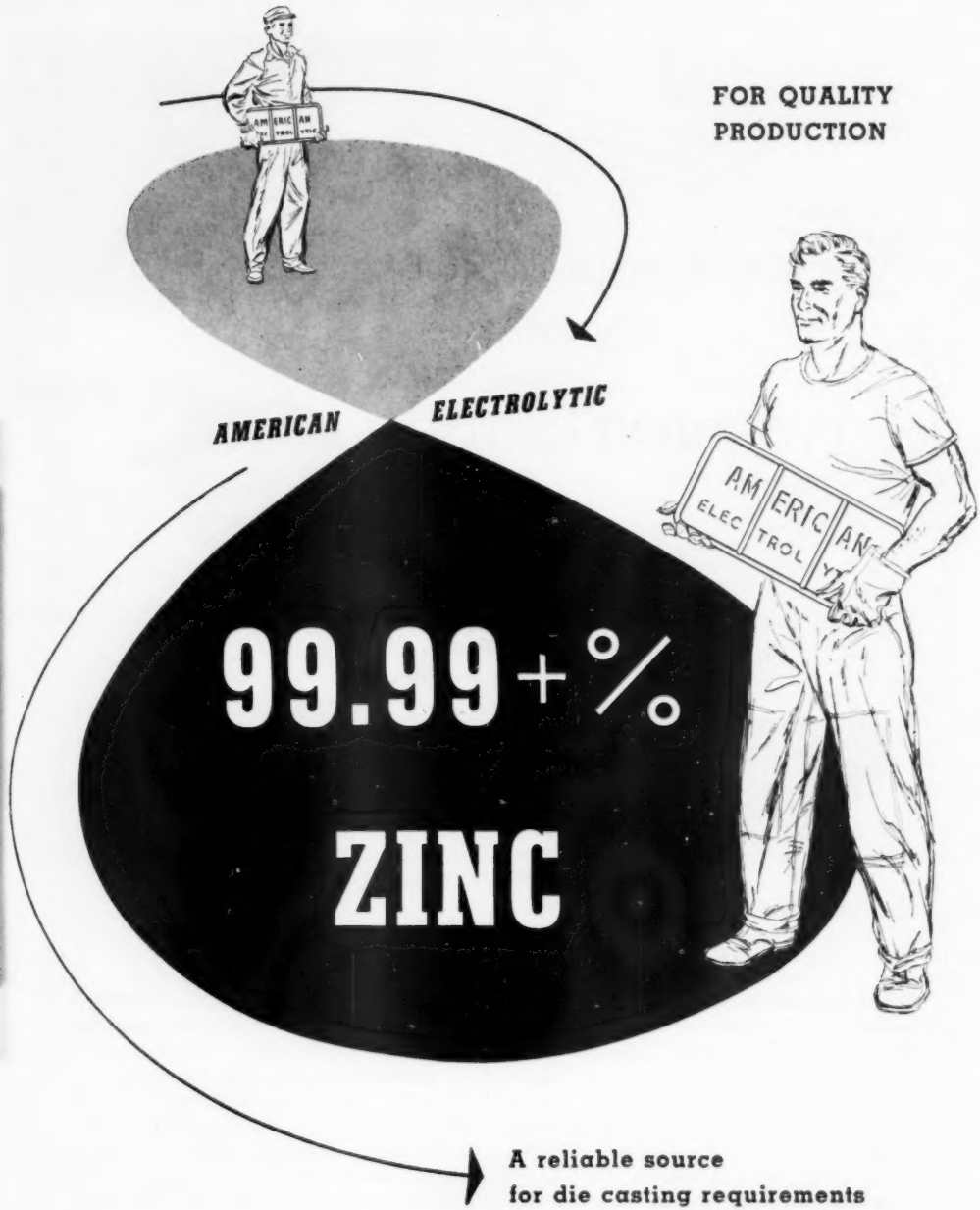

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Distributors for

American Zinc, Lead & Smelting Company

Columbus, Ohio • Chicago • St. Louis • New York

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producing **BIG** ones?

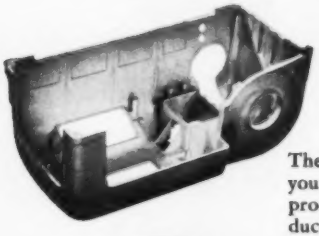
or small ones?

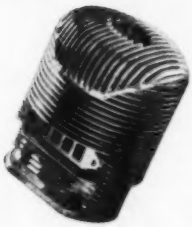
using various types of alloys?

all your requirements for profitable die casting can be met with the

Model 400 CLEVELAND

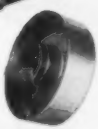
Die Casting Machine



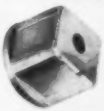


The Model 400 Cleveland Die Casting Machine will give you precision quality castings at a highly profitable rate of production. Castings may range in size from tiny parts produced in multiple cavity dies, to single castings weighing as much as 16.1 lbs. in zinc, or 7.5 lbs. in aluminum. *Universal* in design, the Model 400 can be quickly converted from zinc, tin or lead casting to aluminum, magnesium or brass casting, by changing the hot metal end.

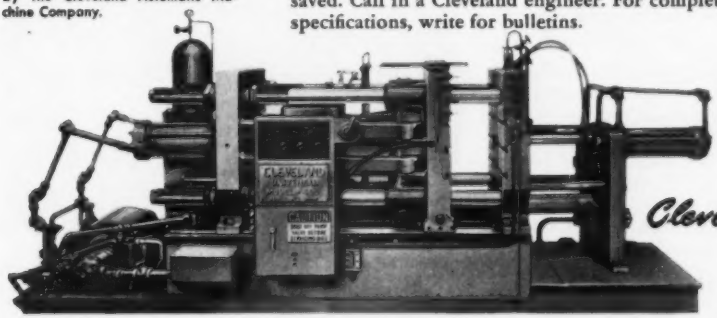
Cleveland design gives you easy access to dies; ample die area; sure-fire shot mechanism; rapid, positive core pull and ejection; safe and simple control—either manual or automatic. Heavy, rigid construction and massive toggle linkage lock dies with tremendous pressure. Cleveland's high injection speed and pressure produce sound, dense, *hardware finish* castings. Dimensions are held to close tolerances; cored sections are precision-cast.



The nation's leading producers of die castings rely on Cleveland dependable performance—for around-the-clock production! You should find out now how Cleveland machines can improve *your* die casting production with money saved. Call in a Cleveland engineer. For complete machine specifications, write for bulletins.



Cleveland Model 400 High-Pressure Hydraulic Die Casting Machine. 36" x 38" die plates; 400 tons locking pressure. Die casting machines of smaller capacities are also produced by The Cleveland Automatic Machine Company.



Remember

Clevelands Cut Costs

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For additional information circle No. 22 on the Reader Service Card

Complicated Castings?

H-P-M "400" Die Casters Produce them for *Mall* Tools!

Mall Tool Company reports—"Our three H-P-M Die Casters work 17 hours a day, 5½ days a week and are giving excellent service".

Mall's famous line of portable tools calls for a wide range of die castings . . . many of them complicated castings of intricate design . . . all produced on H-P-M's.

H-P-M's new Model 400-B high speed die casting machine, with built-in nitrogen accumulator, offers injection speeds up to 400 ft. per minute and produces aluminum castings weighing up to 12.2 lbs. Other design features include all-hydraulic die clamp for fast, simple die change-over . . . hydraulic ejectors . . . dual hydro-electric safety devices . . . maximum injection pressure when die is filled . . . and independent handwheel adjustment for both die clamp and injection pressures.

Discuss your die casting problems with an H-P-M engineer and profit from 75 years of specialized experience in the field of hydraulics.

SPECIFICATIONS MODEL 400-B

Size of Die Plates	Space Between Bars	Die Opens	Maximum Die Space	Capacity Per Shot (Lbs.)	Net Wt. (Lbs.)
38"x38"	23"x23"	16"	42"	2.2 to 12.2 (Al)*	40,000

NOTE: The model 400-B handles brass and magnesium die casting as well. Complete specifications on request.

Write for Catalog 5106, today!

HPM 75th YEAR

THE HYDRAULIC PRESS MFG. COMPANY

1094 MARION ROAD
MT. GILEAD, OHIO, U. S. A.

Builders of Presses for the Metal Working & Processing Industries • Plastics Molding Presses • Die Casting Machines • Hydraulic Pumps, Valves & Power Units

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DIE CASTING

keys production to speed, accuracy and economy

CASE HISTORIES FROM MT. VERNON FILES

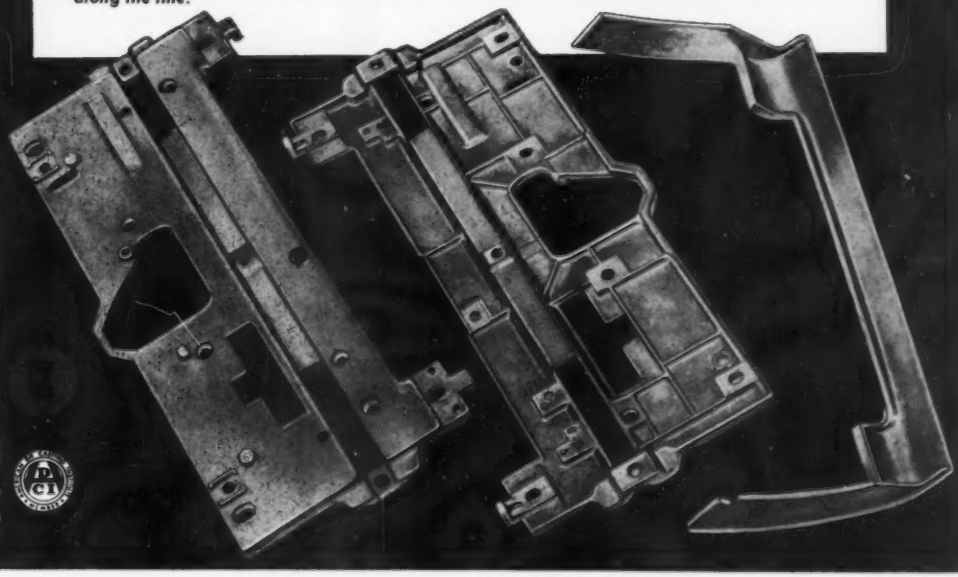
. . . keys it from A to Z — from blueprint to finished product. For die casting is industry's cost-cutting method of producing accurate parts for thousands of applications.

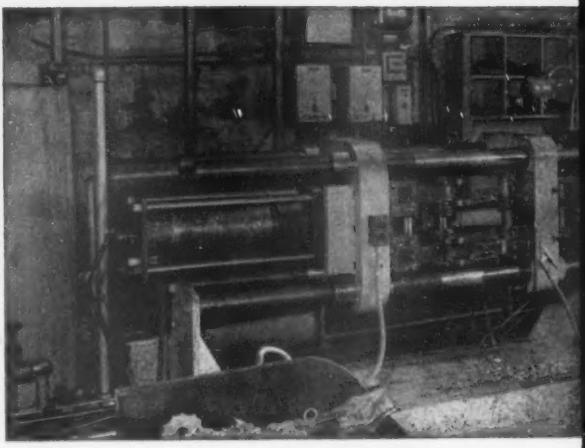
Take the modern typewriter, for example. Few machines of comparable size and weight have to "stand the gaff" so well, but die casting supplies important components, with outstanding strength-weight ratios, that enable it to do a thorough job—***and stay on the job indefinitely.***

Two such parts are shown here: a top plate and a keyboard guard for Smith-Corona typewriters, cast from aluminum by Mount Vernon. Each is produced instantly, as the die closes, complete in every detail—holes, slots, notches, pads, channels, studs, ribs, counterbores as required. Both have perfect contour fit. Only a negligible amount of machining is necessary. Savings are thus substantial ***all along the line.***

Whatever your product, simple or intricate, consult with us. We have up-to-the-minute facilities for die casting aluminum and zinc, and a vast reservoir of experience. It's very possible we can key your production to increased output and lower unit costs . . . show you the way to improved products, too.

MT. VERNON
DIE CASTING CORP.
MT VERNON NEW YORK





PYDRAUL SAVES LIVES

Officials and employes of Smith-Johnson Corporation, Los Angeles, are glad the company switched to Pydraul F-9, Monsanto's nonflammable-type hydraulic fluid.

A line leak caused Pydraul F-9 to be sprayed over the area of a die casting machine and zinc melting pot. There was no flash . . . no fire.

Although the operator of the machine was drenched and fluid was sprayed on about a half dozen men who were observing his job, no one was seriously injured.

You can switch to safe, efficient Pydraul F-9 simply by draining your present fluid and refilling. For details, contact the nearest Monsanto Sales Office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1749-A South Second St, St. Louis 4, Mo.

Pydraul: Reg. U.S. Pat. Off.

PYDRAUL

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"Sure, I know The Hoover Company motto is to ship 'em anywhere—on time. But don't you think their shipping department could have made a mistake in address—just this once?"

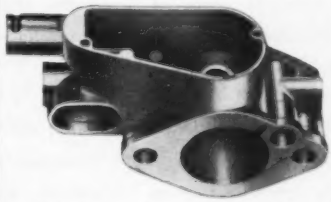
As you want them when you want them... where you want them... Hoover Die Castings

Hoover has a reputation for getting die castings out as promised, getting them where they're wanted on time, and with every specification right on the nose.

Made from zinc and aluminum alloys, Hoover Die Castings can be formed to almost any shape, produced in almost any size, and turned out rapidly at low cost.

In many products, Hoover Die Castings can replace more expensive metals, eliminate costly steps in production and assembly—give improved performance and appearance, too.

And from drawing to delivery, Hoover is set up to handle every phase of the job, and to work closely with your own designers and engineers.



This die cast flange, turned out by Hoover, is an important part of a famous automatic "governor" for trucks and busses. May we show you other examples of Hoover Die Casting? Write for free booklet, or for a Hoover engineer to call.

THE HOOVER COMPANY, Die Castings Division, North Canton, Ohio

HOOVER

Specialists in the field of die castings since 1922

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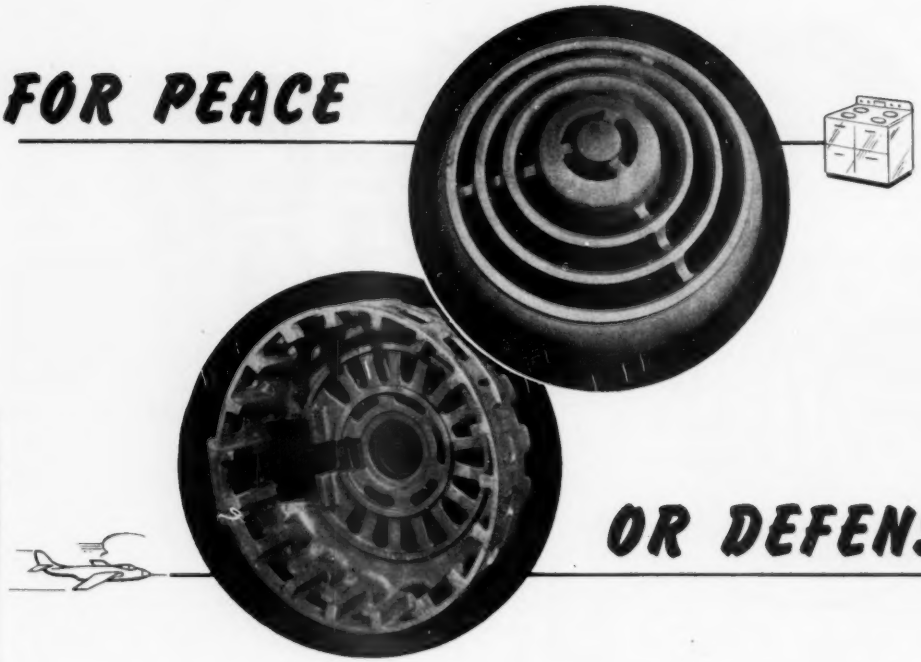
FOR PEACE



OR DEFENSE

ACME HAS THE EXPERIENCE

ALTHOUGH the bulk of Acme's production during recent years has consisted of peacetime products, much of it for the appliance manufacturers, we have never discontinued defense production.

During all this period, both during and since World War II, we have been continuously producing precision castings for aircraft, and for numerous complicated ordnance parts.

ACME OF CHICAGO offers a complete casting service — for aluminum alloy permanent mold and semi permanent mold castings and aluminum and magnesium alloy sand castings.

Acme engineers will work with you on problems of design, cost of producing samples, production costs, and cost of patterns or permanent molds to produce high quality castings.

ACME

ALUMINUM FOUNDRY CO.
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CHICAGO 36, ILLINOIS
TELEPHONE — PROSPECT 6-5035

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"That's the Engineer who Specified Parker *Die Castings!*"

FIRST of all, this engineer saw the value of using the Die Casting technique for that difficult part. Even though the run was small, considerable savings were realized since no machining or finishing operations were necessary. He knew that Parker was the right choice to produce the casting, for Parker devoted almost their entire output to the aircraft industry during the last war. They became "aviation specialists," so to speak.

Parker is one of the oldest names in Die Castings. Our entire effort here is in the production of die cast parts for literally all types of industries.

Call in Parker engineers on your next quotations.

And when you think of Die Castings -- **THINK OF**

Parker White Metal Company • 2153 McKinley Ave. Erie, Penna.

PARKER ALUMINUM *and* ZINC *Die Castings*

AN ARRESTING EXAMPLE

OF THE SCOPE OF THE

MADISON-KIPP

Aluminum

DIE CASTING PROCESS

THE aluminum housing for parking meters here illustrated is four pound casting with an irregular shape and both thin and thick sections. Only a very small amount of machining is required before assembly. It is a good example of the advantages of the Madison-Kipp die casting process.

Please send all inquiries to our home office in Madison.

- *Skilled in* DIE CASTING *Mechanics*
- *Originators of Really High Speed* AIR TOOLS
- *Experienced in* LUBRICATION *Engineering*

MADISON-KIPP CORPORATION

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From Blueprint to Finished Part

For Military or Essential Civilian Zinc Alloy Die Castings Consult

SCHULTZ

Our ability consistently to furnish dimensionally accurate castings with superior surface finish has established us as a leading supplier of zinc base alloy die castings. Our engineers will welcome the opportunity of demonstrating how these advantages can be incorporated in your products.

SCHULTZ DIE CASTING COMPANY
1810 CLINTON STREET • TOLEDO 7, OHIO

For additional information circle No. 80 on the Reader Service Card

What is zinc?

zinc (zĭŋk), *n.* [G. *zink*, prob. akin to *zinn* tin: cf. F. *zinc*, fr. G. Cf. TIN.] **1.** *Chem.* **A bluish white crystalline metallic element, brittle when cold, malleable at 120-150° C. (250-300° F.), and very brittle at 200° C. It is practically unaffected by air and moisture at ordinary temperatures. Symbol, *Zn*; at. wt., 65.37. Zinc melts at 420° C. (788° F.). At about 930° C. it boils, yielding vapors which burn in air, forming the oxide. Sp. gr. of zinc, 7-7.2. Weight of a cubic foot, 437-450 lbs.**

WHILE the above description of metallic zinc is basic, it tells the layman nothing of the manifold and highly essential functions this versatile engineering material performs. For zinc is frequently used in conjunction with other metals, and then its identity may be more or less concealed. For example, the great volume of iron and steel products which are galvanized, i.e., zinc coated, as protection against corrosion has for many years accounted for the metal's largest single use — averaging over 40% of the total annual slab zinc consumption in the United States. In brass, of which it is an essential constituent, the zinc is invisible. Zinc oxide, which is particularly important as a print pigment and as a rubber ingredient, is a fine, white powder which gives no hint of its relationship to the base product.

The die casting industry, a comparatively young but vigorous newcomer in the field, is steadily gaining on galvanizers as the chief outlet for zinc — accounting for more than 30% of total annual consumption. Zinc alloy die castings are used for many structural parts in the automotive, electric appliance, and business machine industries. Since zinc base die castings are often covered with a great variety of beautiful finishes for decorative purposes, the metal's identity is again concealed. For example, the average individual probably does not realize that most of the plated parts on modern automobiles and household appliances are zinc die castings.

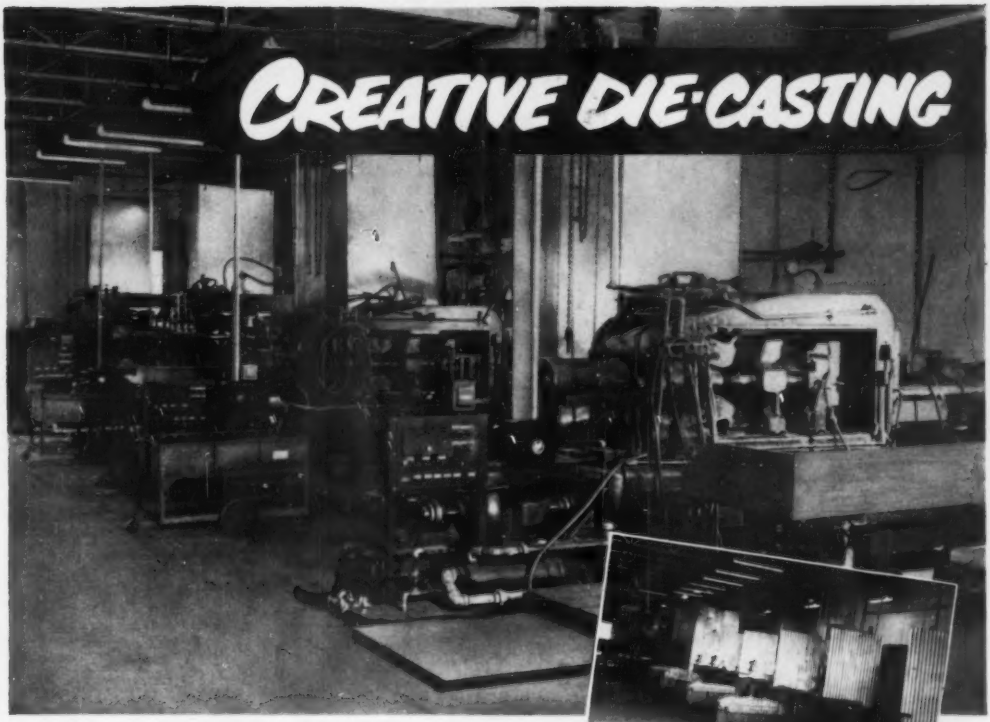
Die castings are produced from six basic metals: tin, lead, zinc, copper, aluminum and magnesium. Zinc, by far, accounts for the major tonnage chiefly because of its low melting point, easy castability, dimensional stability of the casting and its adaptability to a wide variety of finishes.

Eastern Sales Agents: ST. JOSEPH LEAD CO., 250 PARK AVE., NEW YORK 17

Bunker Hill Zinc 99.99+%

Sales Office for Pacific Coast: NORTHWEST LEAD CO., SEATTLE, WASH.

CREATIVE DIE-CASTING



THAT MEETS THE CHALLENGE OF YOUR PRODUCTS

We are keeping pace with industry's development in order to serve your requirements better.

Our modern plant with complete design and engineering facilities assures you the ultimate in die casting quality.

Write for your booklet!

"The inside story" of New England's largest and most modern die casting plant illustrates why our castings are used to make many of America's leading products.

40,000 SQUARE FEET OF MODERN FACILITIES

THE NEW ENGLAND DIE CASTING COMPANY

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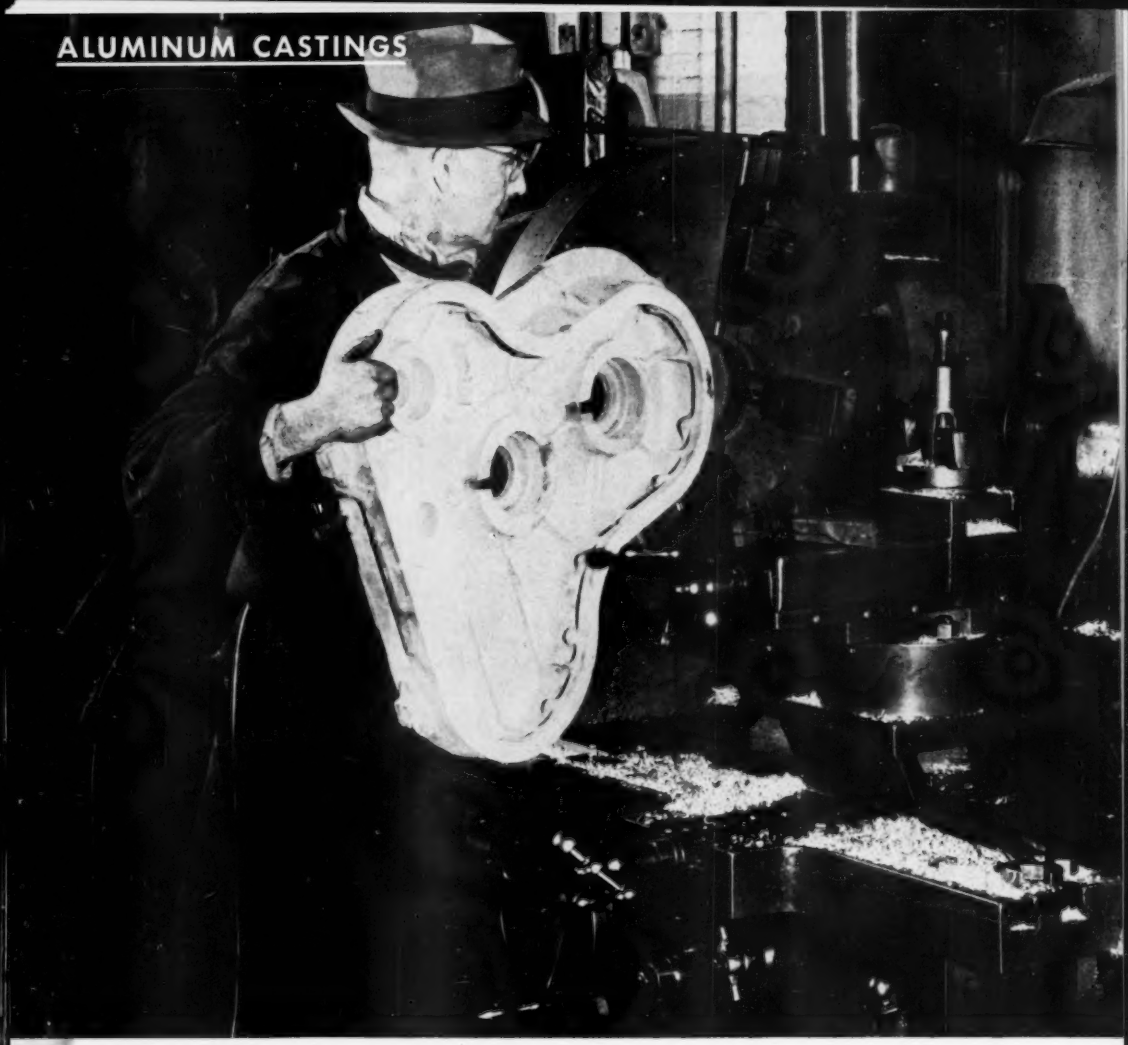
ALUMINUM CASTINGS



CASTINGS YOU CAN LIFT WITH EASE

ALCOA makes four kinds in aluminum—sand, plaster, permanent-mold and die

You don't have to look farther than your own shop to see the advantages of castings that weigh one-half, even two-thirds, less. Think how often castings are lifted while being machined, finished, assembled, and shipped. The savings in man power with aluminum castings are impressive.

Look, too, at the other commercial advantages of Alcoa Castings. Ease of machining. Corrosion resistance. High conductivity of heat and electricity.

How about price? Alcoa Castings are competitive with castings of many other metals. Their cost, finished and assembled in your product, often amounts to surprising savings over heavy metals.

We have been making aluminum castings for 41 years. We have been working with aluminum for 64 years. To aluminum's natural advantages, we add the extra measure of sound and skillful design help. Any of our four foundries or two die-casting plants, located from coast to coast, are open for your inspection. Contact your local Alcoa Sales Engineer, listed under "Aluminum" in the classified phone book.

ALUMINUM COMPANY OF AMERICA

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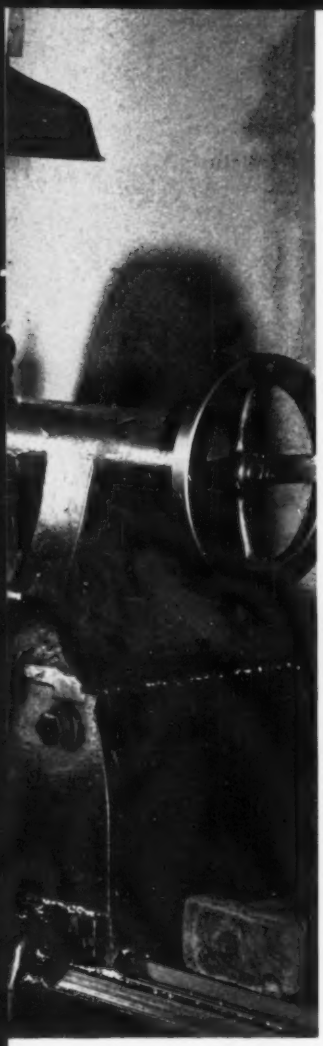
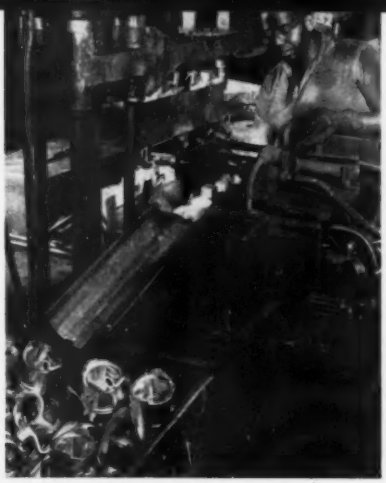
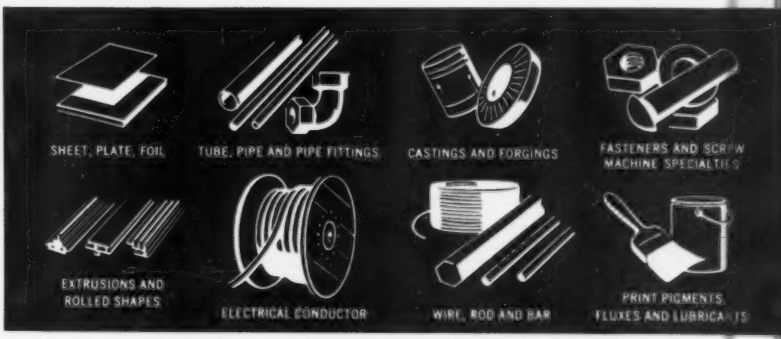
ALCOA ALUMINUM ®





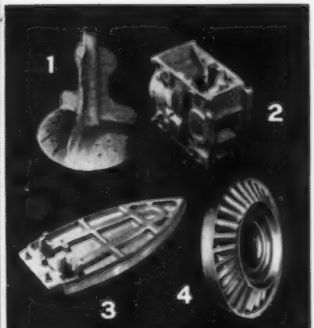
High production of permanent-mold castings in Alcoa's Cleveland foundry is illustrated by this automatic machine for making pistons.

Dimensional check of a completed die in Alcoa's die-casting plant at Chicago.

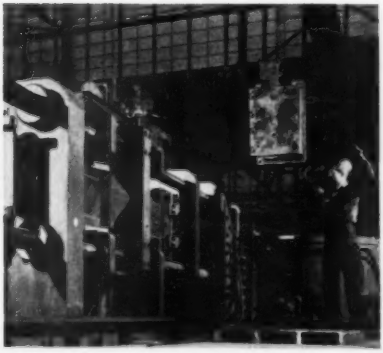


Remember, ALCOA makes "everything" in aluminum

While the sale of our products is limited by government regulations, you'll find no limitations on help in design, application, or fabrication.



Typical castings made by Alcoa. 1. Permanent-mold washing machine agitator. 2. Sand-cast machine part. 3. Die-cast electric iron soleplate. 4. Plaster-cast automotive torque converter.



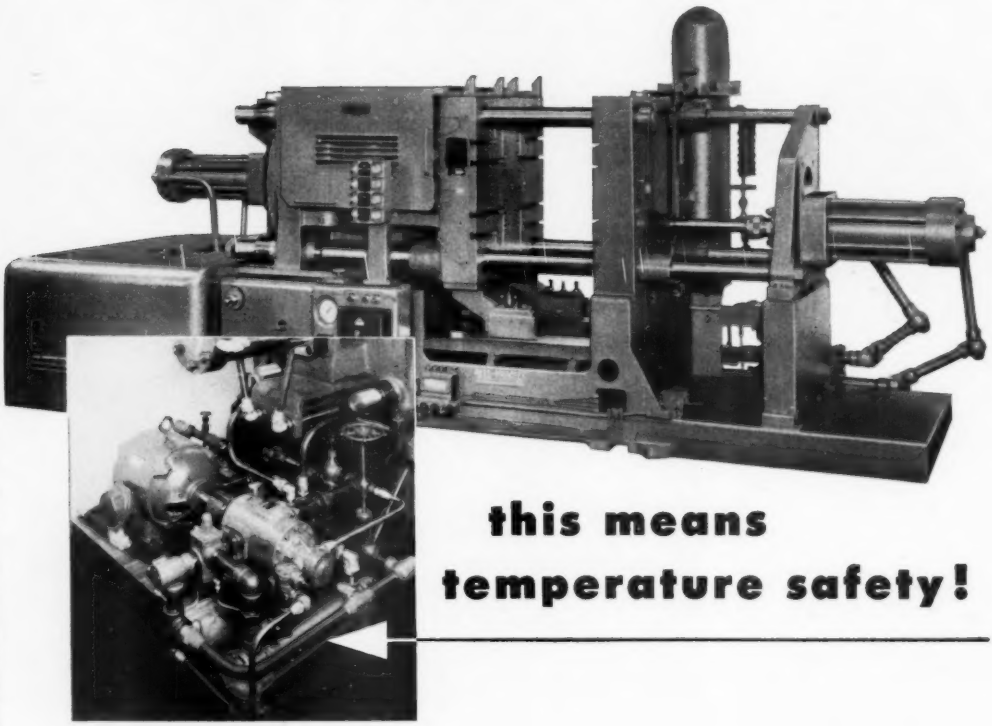
Setting a die in a large die-casting machine at the Chicago plant.

A line of automatic molding machines, indicating the high production capacity for sand castings at Alcoa's Bridgeport, Conn., foundry.

For additional information circle No. 5 on the Reader Service Card

On Reed-Prentice Die Casters . . .

on any hydraulic machines



this means temperature safety!

Metal working industries utilizing Reed-Prentice Die Casting Machines have long profited from built-in temperature protection . . . because a Ross Type BCF Exchanger has been on the job to safeguard the hydraulic fluid.

For years, Reed-Prentice machines, like the Model No. 2G shown, for aluminum, magnesium and brass alloys, have incorporated the performance-proved Ross "BCF" as factory equipment. To the user, it has meant continuous production, unhampered by pump slippage and other damaging effects of excessive oil temperatures. To Reed-Prentice Corporation of Worcester, Mass., it has meant a fast and reliable answer to heat removal needs . . . *fast because the "BCF" is a fully standardized, pre-engineered unit available from stock . . . reliable because of its durable copper and copper alloy construction, its careful engineering.*

For data, request new Ross Bulletin 1.1K5.

ROSS HEATER & MFG. CO., INC., Division of American Radiator and Standard Sanitary Corp., 1396 West Avenue, Buffalo 13, N. Y. In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

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New

MILWAUKEE PLANT Offers Every Facility for Complete Die Casting Service

Founded in 1909, and a pioneer in its field, the *Milwaukee Die Casting Company* has expanded its facilities through the years to give its customers every possible advantage of the die casting process.

Now, the completion of its new plant . . . in an entirely new location with ample space for future expansion . . . heralds further extension of those basic policies which have satisfied MILWAUKEE customers for more than forty years. Here every modern facility for the production of precision die castings is included in an efficient one-floor layout to make MILWAUKEE . . . more than ever . . . a dependable source of Complete Die Casting Service.

MILWAUKEE DIE CASTING COMPANY

4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN

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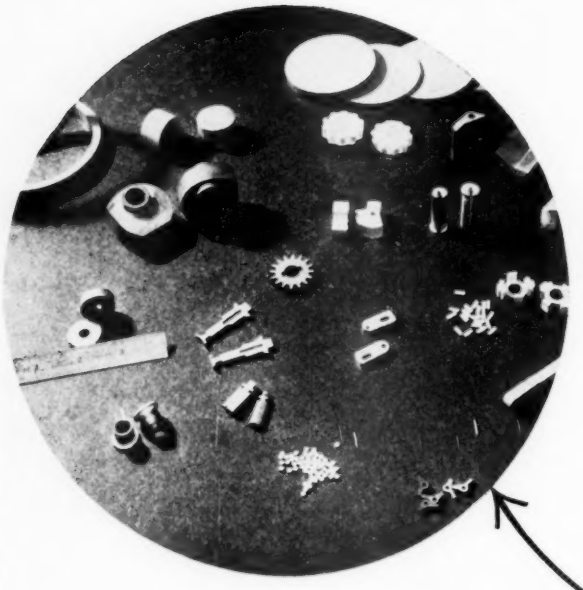


THE SAME PARTS COST LESS

WITH POWDERED METAL PRODUCTION

BY

kwikset LOCKS, INC.

the resources of powder metallurgy
are now available for the first time on the west coast.
To learn the complete story of powdered metal
write to: **powder metallurgy division**
kwikset locks inc.
anaheim, california

available soon — *a sound and full color movie on powder metallurgy*

For additional information circle No. 49 on the Reader Service Card

The 1952 metal powder show . . .

Powder metallurgy in a defense economy

. . .many phases of this vital subject will be reviewed in detail as the Metal Powder Association holds its eighth annual meeting and the 1952 Metal Powder Show in Chicago this month.

Here are the highlights:

AS HAS been the case with many others, the powder metallurgy industry has found that as it grows there is a need for some sort of a co-ordinating group to deal with the problems peculiar to powder metallurgy. The development of adequate standards for both raw materials and finished products requires methods and procedures that are far different from those employed in other phases of the metal working industry. The interchange of ideas and technical information, while possible at the meetings of the larger and broader metallurgical societies, is best done within the industry itself where all subjects discussed are not of primary interest to the powder metallurgist.

The realization of these and other needs in developing powder metallurgy from an art to a science were recognized some years ago and have resulted in the organization of the Metal Powder Association, meeting for the eighth time on April 29 and 30 in Chicago's Drake Hotel.

With national emphasis being placed on re-arming, it is not surprising that the papers to be presented lean heavily on the military uses of powdered metal parts. There is, however, sufficient diversity so that the technical sessions should prove of interest to every one connected with the industry.

The Metal Powder Show being held jointly with the meetings of the MPA will give an excellent cross-section of the powder metallurgy industry with exhibits from powder sup-

. . . PMM salutes . . .

In recognition of the enormous strides made by the powder metallurgy industry during the past several years, PMM presents the following editorial material to highlight current practice and new developments.

• HIGH DENSITY IRON COMPACTS, a review of methods and applications of iron powder parts at or above 85 percent of theoretical density begins on page 32.

• CONTROLLED FRICTION through use of porous bronze clutch shoes is the subject of an article on page 31.

• THE MEANING OF PRECISION as applied to metal powder parts is surveyed in an article beginning on page 36.

• ELECTRONIC APPLICATIONS which compose a major use for powder metallurgy get attention in an article on page 38.

• POROUS BEARINGS with built-in oil well are a comparatively new development of the self-lubricating bearing. See page 35.

• THE FIRST DIRECTORY of the powder metallurgy industry begins on page 53 and includes fabricators, powder suppliers and equipment manufacturers.

• FINISHING TECHNIQUES suitable for powdered metal parts are reviewed in an article beginning on page 83.

• EXHIBITORS at the MPA show are listed on page 30.

pliers, fabricators, equipment manufacturers and others. With both good technical sessions and a better than usual show it is hoped that the attendance will pass the 1950 mark of 503.

A complete list of exhibitors is presented here. The MPA meeting program is presented on pages 112 and 113.

SPEAKING OF POWDERED METAL . . .

Carbide cores for ordnance

Malcolm F. Judkins

Magnetic materials

Eberhard Both

POWDER METALLURGY IN NATIONAL DEFENSE is the subject of Capt. John Dale (right) of Frankford Arsenal, shown here with G. Hershman, G. Rove and G. S. Van Dyke, Jr., also of Frankford Arsenal (left to right).

Clock mechanisms

Fred Lux

Electronic core materials

R. H. Rodrian

Exhibitors at the MPA show

Booth	Exhibitor
2	New Jersey Zinc Co.
3	Machine Design Magazine
4	Electric Furnace Co.
5	Western Gold and Platinum Works
6	Metals Disintegrating Co.
7	Antara Products Div., General Dyestuff Corp.
8	Radio Cores, Inc.
9	Harper Electric Furnace Co.
10	Ekstrand and Tholand, Inc.
11, 12, 13	F. J. Stokes Machine Co.
14	Precision Metal Molding Magazine
15	Welded Carbide Tool Co.
16	Stackpole Carbon Co.
17	Magnetic Powders, Inc.
18	Powdered Metal Products Corp.
19	Federal-Mogul Corp.
20	Westinghouse Electric Corp.
21	Materials & Methods Magazine
22	Johnson Bronze Co.
23	Plastic Metals Div., National Radiator Co.
24, 25	Amplex Manufacturing Co.
26	The Glidden Co.
27	Lindberg Engineering Co.
28	Arthur Colton Co.
29	Charles Hardy, Inc.
30	The Wel-Met Co.
31	Metal Hydrides, Inc.
32	Kux Machine Co.

AS A FRICTIONAL MATERIAL, powdered bronze compacted into appropriate shapes and sintered becomes an outstanding clutch component. These parts, shown front and back, are the clutch discs which give the Porter-Cable saws their new, unique safety feature.

Friction properties of powdered bronze

give new saw safety device

THE ability to furnish components having special physical properties is one of the most useful attributes of powder metallurgy. Machine designers have been discovering that where they need specific characteristics such as friction or bearing surfaces, they can obtain them quite readily from components formed from metal powders.

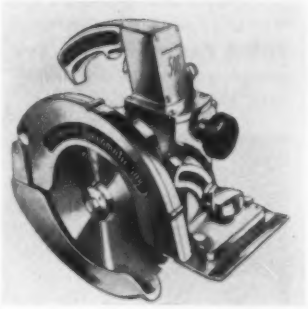
An example of this type of specified property in a machine component is to be seen in the new models of portable, circular saws manufactured by The Porter-Cable Machine Company of Syracuse, N. Y.

Outstanding feature of these new saws is a special kick-proof clutch* which is a unique safety device designed to protect the operator, the saw and the workpiece. The principle of this safety clutch depends upon a small clutch disc which needs to have exactly the right friction characteristics.

Porter-Cable has obtained this performance feature by means of clutch disc produced from bronze powder by International Powder Metallurgy Co. of Ridgway, Pa., who provide parts having closely controlled density and impregnated with a special, synthetic lubricant.

Purpose of the clutch is to slip when an excessive load is applied, such as occurs when the saw blade binds in a heavy piece of wood or knot. One of the biggest hazards in using circular saws has been the danger of kick-back when such binding happens. Now, by means of the new kick-proof clutch, this hazard has been completely eliminated.

The vital importance of securing exact friction and slippage characteristics thus becomes apparent. The clutch must engage fully under normal operating conditions, but must be instantaneously released when an overload is applied.



WHEN THE BLADE BINDS or strikes an obstruction, the clutch allows the blade to slip, rather than causing injury to operator, motor or workpiece.

The friction discs perform this duty dependably. International Powder Metallurgy supplies the components in finished form, held within required dimensional limits and performance specifications.

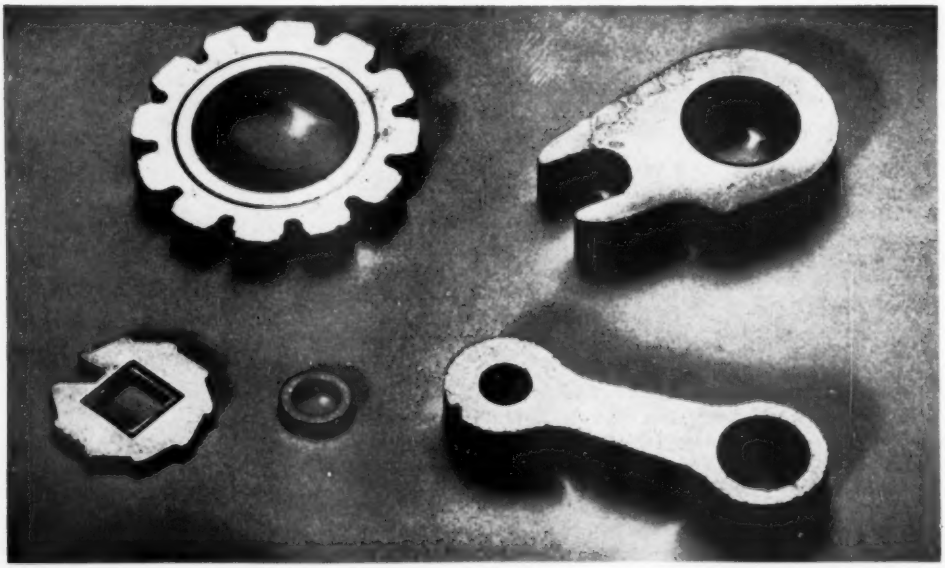
* Patent applied for.

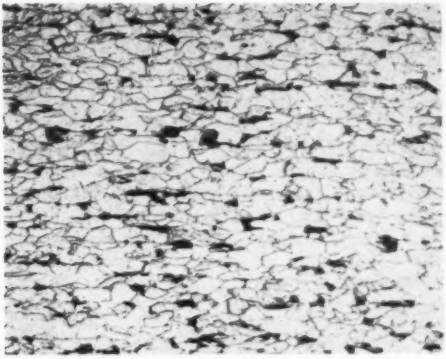
HIGH DENSITY IRON POWDER PARTS

- Are high density iron powder parts feasible on a production basis?
- What physical properties can be obtained?
- What special processing techniques are employed?
- Can high density parts from iron powder compete with stamped or machined parts on cost basis?
- What are some current applications?
- What special considerations are necessary for the designer to know about?

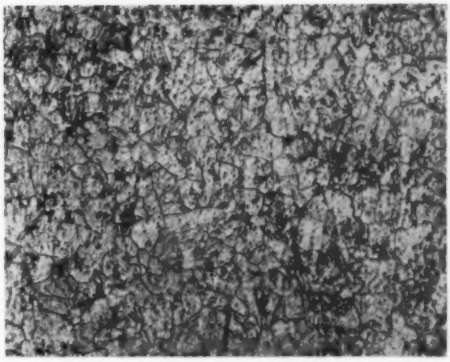
By PHILIP R. KALISCHER
Associate Editor

THESE PARTS COULD HAVE BEEN MADE FROM ROLLED OR BAR STOCK but are now typical iron powder parts with high density. Physical properties equal to those secured from rolled strip stock have been obtained at lower cost. (All photos and data courtesy of National Cash Register Co., Dayton, Ohio.)





SAE 1010 strip stock, blanked & punched (100X 2% Nital etch)



Powdered iron after first sinter (100X 2% Nital etch)

STRIKING SIMILARITY in structure between high density iron powder parts and the same part made from strip steel is shown in the photomicrographs above. The absence of original grain boundaries and porosity in the powder part is particularly noteworthy. Density of the powder part is 99 percent that of the strip stock.

IRON powder compacts of high final density are today of outstanding interest and will, unquestionably, become of primary importance in the powdered metal industry.

Two factors have contributed to the slow acceptance by industry of high density compacts. The first has been a lack of knowledge of the mechanics of making such parts; this is rapidly being overcome so that today that knowledge is more wide spread. The second factor has been the all too common belief that die life must necessarily be low due to the high forming pressures that must be used. The use of cemented carbide dies has eliminated this problem.

Before discussing the properties and method of manufacture of these compacts it will be desirable to define more exactly just what is meant by a high density compact. Originally, an arbitrary dividing point was made at a density value of 85 percent of theoretical. Assuming an average density value of rolled punching stock, about SAE 1010, at 7.7 g/cc we have a density of 6.54 g/cc as the lower limit for these compacts.

Density is not the only determining factor, however, for a part properly to fall within this category the physical properties must approach or equal the physicals of a piece of rolled steel of the same carbon content and temper. The powder compact must also respond to the various standard shop operations such as machining, hardening, joining and finishing almost as well as wrought material of comparable composition.

A third condition is desirable, but not always of primary importance. The part in question should be made at lower cost than a comparable part made from plate, strip or bar stock.

As far as usage of these high density parts is concerned, they may replace any machined part of comparable strength. The only limitation is that the shape must be such that it can be molded.

One use of powder parts that is often overlooked is in the manufacture of semi-finished parts on which some machining is done after sintering. Very often a marked cost saving can be made by this procedure as well as to secure parts which might otherwise be unavailable because of material shortages.

A factor that the designer must watch is not to over-design. A multitude of cases exist where a part is made of a material many many times as strong as it needs to be only because steel for example was an available material when the design was originally conceived. Many of these parts can be replaced with much less costly powdered iron parts of medium density whose physical properties may not be as high as the part they replace, but are adequate for the job at hand. Examination of machine components for such parts will often develop a number of parts that can be made from metal powders at a substantial cost reduction.

In the manufacture of high density compacts, the grade of iron powder used is of considerably greater importance than is the case with

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(Editor's note: In the final of this series of five articles, the processing of high density parts by the National Cash Register Co. will be described in detail. This article will also contain a description of some of the parts made and the properties obtained in the high density parts made from iron powder. Previous articles discussed medium density iron powder parts.)

low density compacts. Since the final compact must be structurally a duplicate of wrought metal it follows that any impurities in the powder which will slow down or prevent adequate and rapid solid diffusion in the first place and grain growth and recrystallization in the second place must be avoided. Silica (SiO_2), alumina (Al_2O_3), manganese oxide and the oxides of the refractory metals are particularly harmful.

Particle size and particle size distribution are primary variables. Of more importance than the particular sizes and the size distribution is uniformity from batch to batch of the powder as furnished to the fabricator. Once a suitable powder has been found, a set of specifications must be drawn in co-operation with the powder supplier to assure a continuing supply of the proper grade of raw material.

Other than purity and size distribution raw material factors that must be covered by specifications rigidly adhered to are apparent density, flow rate, green density, and hydrogen loss. While it may be argued that these are the problems of the fabricator, the designer must be aware of them to avoid writing product specifications that can not be met by the fabricator.

If a powdered iron compact is to fall in the group of high density compacts as defined, it follows that during the sintering operation there must be a high degree of solid diffusion among the individual particles so that initial particle boundaries are eliminated and a normal crystal structure results. Such voids as are present in the green compact must be eliminated to as great a degree as possible.

If the desired recrystallization and grain growth are to take place, inter-particle contact must be of a high order. This requires that the increase in density during sintering be held to a minimum and about 5 percent has been found to be a desirable maximum. If greater densification during sintering is attempted the time at high temperatures that is required becomes uneconomically long and the shrinkage and distortion of the compact is so great that good control of dimensions is difficult.

By using a high green density it is possible to hold shinkage in all directions to a sufficiently small amount so that the sintered compact will consistently run within a tolerance of ± 0.004. Warpage will be practically nonexistant and in many cases the part can be used in the as-sintered condition.

When closer dimensional control is required a coining operation after sintering will enable the producer to hold parts to a minimum of ± 0.001. In achieving this close size control it is imperative that the coining operation be limited to that function and not be used as a means of securing further density increases. If an attempt is made to close voids and increase density during the coining operation the physical properties of the compact will suffer. *The part must be at its final density before coining. This can not be over-emphasized.* In some cases a second sintering operation is given after coining. This second sinter is exclusively for stress relief and to allow further grain growth and recrystallization to take place. During the second sinter there is no change either in dimensions or density.

The structure of a powder part having a density of 99 percent of theoretical after pressing, sintering, coining and a second sinter is shown in Figure 1. The structure of SAE 1010 steel is shown in Figure 2. Comparison of these two micrographs shows that there is little difference in the two materials. The physical properties of the two materials are almost identical and certainly well within the limits of the experimental errors in measurement.

Based upon what has been said above, the design engineer is safe in utilizing the same strength, hardness, impact, and fatigue values for these high density compacts that he would use if designing with low carbon steel. (Values for creep are not known, but this grade of steel is seldom used where creep is of importance).

Since most commercial sintering is carried out in an endogas atmosphere balanced for 1010 steel, the final carbon content of the sintered compact will be 0.10 percent or slightly lower. However, it must be remem-

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MORE INFORMATION IS AVAILABLE . . .

You may find that you need additional data concerning powder metallurgy for some current project or just for your files for future reference. If so, we will see to it that you receive the information you want if you will circle the appropriate numbers on the enclosed Reader Service Card, as indicated below.

EQUIPMENT

235. Powdered Metal Presses
236. Sintering Furnaces
237. Mixing & Blending Equipment
238. Screening Equipment
239. Atmosphere Generators
240. Carbide Dies

POWDERED METAL PARTS

241. Bearings
242. Structural Parts
243. Electronic Cores
244. Magnetic Materials
245. Contact Materials
246. Sintered Carbides
247. Friction Materials

FINISHES

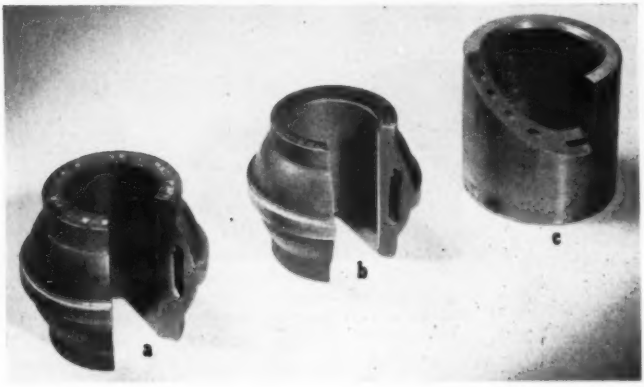
250. Blackening Processes
251. Steam Treatments
252. Chemical Surface Treatments
253. Electrolizing

New-type powdered metal bearing with

BUILT-IN OIL RESERVOIR

DESIGNED to carry heavy loads for long periods of time without the need of added lubricants, the oil well bearing produced by the Michigan Powdered Metal Products Co. of Northville, Mich., is the first radically new design in bearings since the introduction of the so-called self-lubricating bearing introduced over twenty-five years ago. With an oil capacity of from three to five times that of the more conventional self-lubricating bearing made of metal powders, the oil well bearing is rapidly establishing an endurance record.

A BUILT-IN OIL WELL is the special feature of a line of bearings illustrated below. These are three typical oil well bearings showing some of the possible variations in shape of the well and external shape.



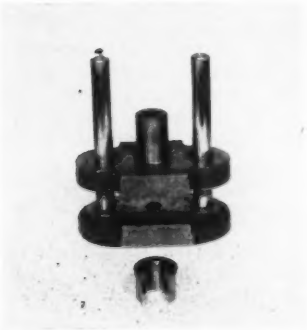
Not only has the introduction of the oil well greatly increased the lubricant capacity of the bushing, but by decreasing the wall porosity from an average of 25 to 30 percent by volume to only 15 percent, the rate of oil flow is decreased, eliminating loss due to seepage where it is not wanted as well as over oiling the friction parts.

Three typical bushings are shown in Figure 1. Bushing "a" is a standard bushing for a self-aligning pillow block. The higher density of the metal parts permits the use of this bushing at much higher loads than is customary. Bushings of this type have been in service for from three to five years with no indication of wear or depletion of the oil supply.

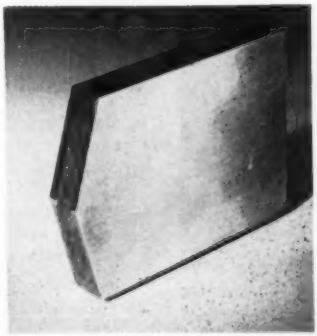
For high speed applications (4000 rpm and higher) a bronze bearing face is desired. This is accomplished in the oil well bearing by forming a wearing surface of porous bronze on the inner surface (Figure 1b). The

continued on page 101

INCREASED USEFUL LIFE of die sets has been secured by using hardened oil well bushings instead of the more customary hardened steel bushings.



TO COMBAT SLIDING FRICTION, this new material has been developed. The porous iron core combined with moderately high density surface, gives a hardenable material well-suited for such uses as machine gibs.

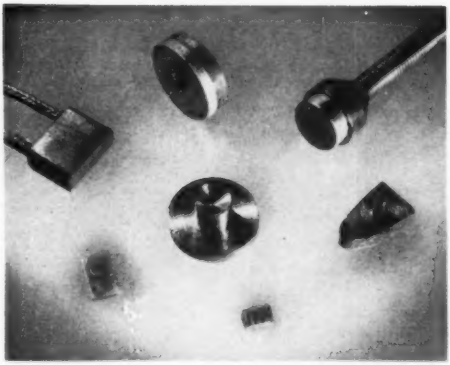


PRECISION IN METAL POWDER PARTS IS NOT LIMITED TO DIMENSION

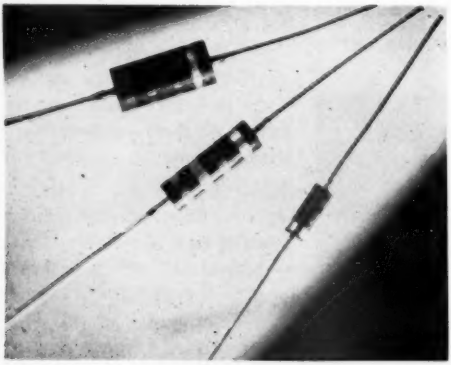
a broader conception of precision for powdered metal components

IN most cases, precision molding refers to the production or manufacture by molding processes of parts to close dimensional tolerances. The concept of precision molding, however, may be expanded into fields in which the molding operation influences the physical properties of the resultant product. Thus, precision molding does not mean just the development of a certain mechanical shape from predetermined materials, but it also includes the generation of some of the essential properties of the materials in the molding operation.

By ERLE I. SHOBERT II
Technical Director
Stackpole Carbon Company



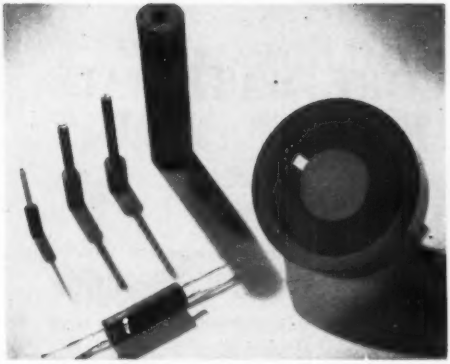
DIMENSIONAL ACCURACY
controlled by proper die fill and molding pressure is the only economical method of manufacturing hard contact material.



CONTROLLING RESISTANCE
by controlling molding pressure is a necessity in the manufacture of resistors for radio use.

The Stackpole Carbon Company has concerned itself with molding operations since its conception, and with very few exceptions, every product which is manufactured by it goes through a molding operation to get its essential characteristics. Products as widely different as ceramic magnets, composition resistors, electrical contacts for circuit breakers and carbon brushes for diesel electric engines all require a precision molding operation in their processing.

Since the properties of all such materials can be widely influenced by the details of the molding operation, the concept of precision acquires new dimensions, in that in addition to the sizes and tolerances, the densities, time under pressure and die design must be carefully considered.



UNIFORMITY OF MAGNETIC PROPERTIES is controlled by the molding technique as long as a constant powder mix is used.

For example, in the manufacture of Ceramag, the Stackpole ceramic magnetic material, the materials are molded from mixtures of metal oxides. The shrinkage and molded density must be coordinated with the die design and the final magnetic properties of the material. Their properties are developed by the subsequent processing which promotes the cubic crystal growth within the material. The result is a non-metallic material held to quite close mechanical tolerances having low eddy current losses and high permeability characteristics far superior to those of conventional iron cores for applications requiring high permeability at low flux densities and medium frequencies. Thus, while the molding operation is only one of the steps in processing, it is an important one which must be kept under strict control.

The composition carbon base resistors used by the millions in the electric industry are another example of precision molding in the extended sense of its meaning. The actual sizes manufactured are more or less standard and the problem of dimensional tolerances only involves the wear of the molds, which are similar to those used in molding plastics.

On the other hand, those properties of the molded piece which largely determine the resistance value and the quality of the resultant resistor must be held under very close control. Fill and molding pressure must be very closely controlled to assure the maximum yield of resistors in the proper resistance range. Here again we have an example of precision molding, but where the mechanical dimensions are secondary.

The molding of carbon plates for carbon brushes used in most types of electrical motors and generators provides a further example of precision molding with very little consideration of the actual dimensions of the molded piece. Dimensional variations may be quite large, since the final piece is machined from the plate material, and therefore the only consideration in molding from the standpoint of the dimensions is that the piece must be large enough to provide sufficient stock, and not too large to give too much waste. However, the plates must be molded to a constant and uniform density. This calls for considerable precision in the molding pressures, in the fill and in the distribution of the fill in the mold. In this field more than in any other in which the Stackpole Carbon Company is engaged, it is recognized that variations in any of the procedures can result in wide differences in performance. Thus each operation, including the molding operation must be kept under very close control.

The manufacture of iron core materials for radio high frequency applications is another example of precision molding. Literally millions of parts commonly in the shape of cylindrical slugs, or round bars with various brass screws or attachments fastened to the ends, must be produced to close mechanical, electrical, and magnetic properties. Mechanical tolerances are close to prevent the piece from changing position in the sleeve which supports it in the coil, electrical tolerances, such as specific resistance of the material, are close to keep electrical losses under control, and magnetic tolerances are close so that the materials will act the same in identical circuits of the mass produced radios and television sets. Here again molding is only one operation, but it is an important one for the final quality and precision of the product.

In the field of powder metallurgy, the molding process must be well under control. Copper

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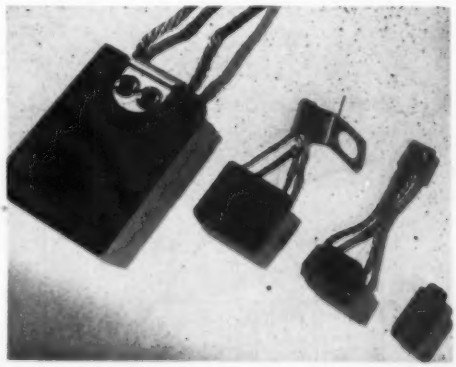
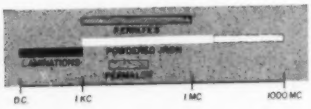


MOLDED TO UNIFORM DENSITY, carbon brushes have constant and reproducable wear and resistance characteristics.

CHARACTERISTICS OF CORE MATERIALS

produced by powder metallurgy



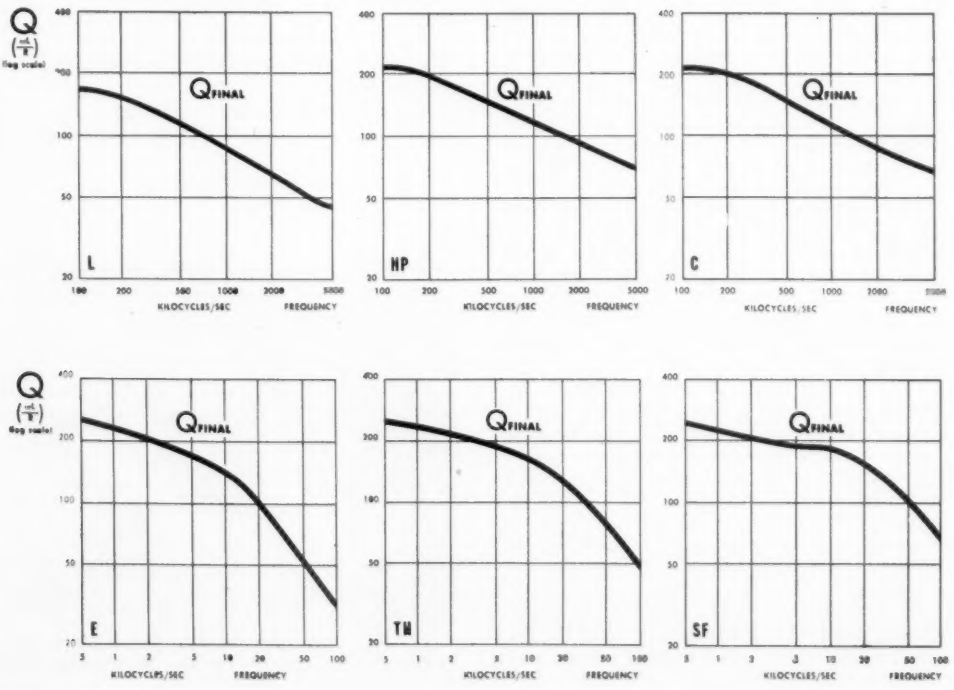
1. MOST EFFECTIVE FREQUENCY range for different types of core materials is illustrated above.

THE use of higher and higher frequencies in electronic work has brought with it the necessity of developing core materials that would operate successfully at these frequencies without excessive loss and would also be of such a size that small compact units could be assembled. This latter point is particularly important in military equipment which must be portable and in many cases susceptible of man carry.

Basically, any core material for this use consists of a soft magnetic material usually composed of a plurality of pieces each of which is electrically insulated from the other. Except for DC circuits where the core may be a solid piece of magnetic material the core materials vary from punched laminations through the different sizes of metal powders to the extremely fine powders (less than 1 micron average diameter). Overlapping this range are the so-called ferrites, a group of metal oxides, having desirable magnetic characteristics.

In Figure 1 is shown a schematic representation of the different types of core material used

2. CHANGES IN Q VALUE with frequency is plotted below for several different grades of carbonyl iron powder.



DO's and DON'Ts in DESIGNING ZINC and ALUMINUM DIE CASTINGS

examples by DOLLIN

PRINCIPLE: In the case of castings with corrugated sides (such as knurls or gears), save machining and trimming die costs, and improve trimming of castings, by incorporating a bead to permit easier gating and trimming.

EXAMPLE: As shown in Fig. 1, the manufacturer's original design for this aircraft conduit cap called for knurls carried to edge a. Dollin engineers suggested adding .040" bead b around the circumference, as shown in Fig. 2.

Fig. 1

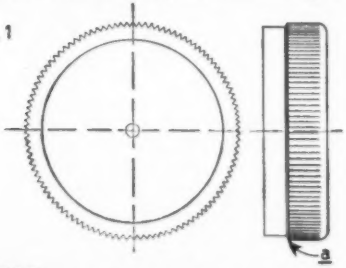
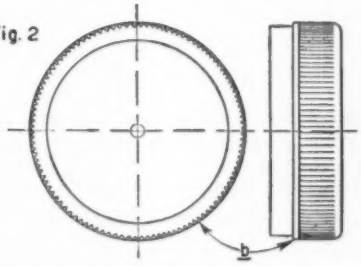


Fig. 2



RESULT: Reduced costs and an improved product for the manufacturer.

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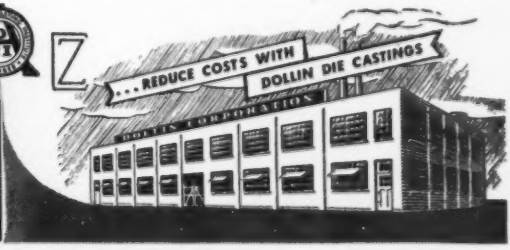

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Table I

Analytical Data for Carbonyl Powders noted in Figure 2

Powder Type	L	HP	C	E	TH	SF
Composition						
Percent iron	99.6-99.9	99.6-99.9	99.5-99.9	98.1-98.7	98.2-98.8	98.2-98.8
Percent carbon	0.01-0.06	0.01-0.04	0.04-0.16	0.60-0.80	0.50-0.70	0.50-0.70
Percent oxygen	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.30
Percent nitrogen	0.00-0.05	0.00-0.05	0.00-0.10	0.55-0.75	0.55-0.75	0.55-0.75
Physical Dimensions						
Average particle diameter in microns	20	10	10	8	5	3
Percent retained on 325 mesh screen	5-20	0.5-2	0-0.5	trace	trace	trace
Particle density g/cc	7.85	7.86	7.86	7.77	7.79	7.81
Apparent density g/cc	1.8-3.0	2.5-3.0	2.5-3.0	2.5-3.5	2.5-3.5	2.5-3.5
Tap Density g/cc	3.5-4.0	4.1-4.6	4.4-4.7	4.4-4.7	4.4-4.7	4.7-4.8

and the approximate frequencies where they operate most effectively. It will be noted that there is considerable over-lap in the frequency range occupied by the cores made from powders. The choice, in this range of frequencies, must be made by considering all factors some of which are:

Temperature stability
Hysteresis and eddy current losses
Residual losses
Di-electric losses in the case of the ferrites
Over the range of about 10 kilocycles to 1000

Table II

Fabricating Data for Carbonyl Iron Cores noted in Figure 2

Powder Type	L	HP	C	E	TH	SF
Insulating Coat. arbitrary units	0.2	0.2	0.2	1.0	2.0	2.0
Binder, percent by weight	1.0	1.0	2.0	5.0	5.0	6.0
Lubricant, per cent by weight	0.2	0.2	0.2	0.5	0.5	0.5
Molding pressure tons/ sq. in.	50	50	40	30	30	30
Surface Treatment, phosphating	yes	yes	yes	no	no	no

megacycles, the range in which powdered iron cores are largely used, the choice of powder type, whether hydrogen reduced, electrolytic, or carbonyl will depend upon design factors.

Ideally speaking, the Q value over the frequency range in which the core is to operate should be as high as possible and constant. Practically, of course, the value for Q always falls off as the frequency is increased. Variations in Q can be secured by changing the type of binder used, the insulating coating, the molding pressure and, perhaps the surface treatment of the particles.

The values of Q and the change with frequency are also dependent upon the particular powder used. Typical of this is the family of curves shown in Figure 2 where the change in Q with frequency is plotted for several different grades of carbonyl iron. The analytical data for these iron powders are given in Table I and the processing factors in Table II. These data are given for one type of iron powder. For other types such as reduced or electrolytic iron similar variations in Q would be observed though the absolute value might be quite different.

For some special applications in the frequency range of about 10 to 200 kilocycles, the so-called permaloys find some applications.

From about 1 kilocycle to about 200 megacycles the ferrites are finding increased application. These materials are basically iron oxide which has been modified to change its magnetic characteristics. The basic ferrite is $FeO \cdot Fe_2O_3$. To change the magnetic properties the FeO is replaced by another oxide of which MnO, MgO, NiO, ZnO, and CrO are the chief ones used. These ferrites are distinct chemical entities having a fixed and definite analysis and a characteristic crystal structure. Since the different ferrites are mutually soluble in each other mixtures that are solid solutions can be made up and in this manner the magnetic properties varied still further.

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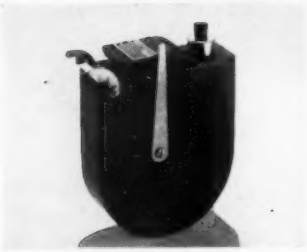


1. TWO HOUSING PARTS for this pen-motor housing are die cast in zinc alloy.

DIE CASTINGS REPLACE SAND CASTINGS TO SAVE MORE THAN 60 PERCENT

THROUGH what line of reasoning and economic considerations does a company design its product to be built initially of sand cast gray iron and subsequently set up a redesign program whereby major structural components are translated, one-by-one, into die castings?

A clear-cut example of this type of evolution from sand casting to die casting may be seen in the development of the oscillograph and penmotor manufactured by the Brush Development Company of Cleveland, Ohio.

At the time this unit was first put into production, it was not possible to determine expected quantities with any degree of accuracy. The pilot run was produced by sand casting, and as additional quantities were ordered, sand castings appeared to be the most direct way of obtaining job lots of from 25 to 50 units with a minimum of capital outlay.

Production tooling was devised and the castings were heavily machined—some of them had almost every surface machined. Due to the high degree of accuracy required and the low initial accuracy of sand castings, somewhat elaborate locating and clamping fixtures were required.

The use of these oscillographs is quite extensive in industry today, with the result that production quantities are larger, steadier and reasonably predictable. They are still far from being "mass produced" but the volume of output is high for the precision instrument field.

As production quantities became stabilized, and it could be seen that a low rate of obsolescence could be anticipated, some thought was given to selecting a faster, less expensive method of producing the most troublesome parts. With low design obsolescence and steady production quantities, an investment in die casting dies appeared to be feasible.

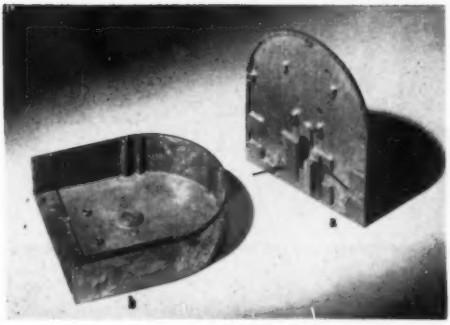
Problems relating to dimension, distortion and cost

The first elements to be considered for redesign as die castings were the penmotor housing and cover, Figure 2.

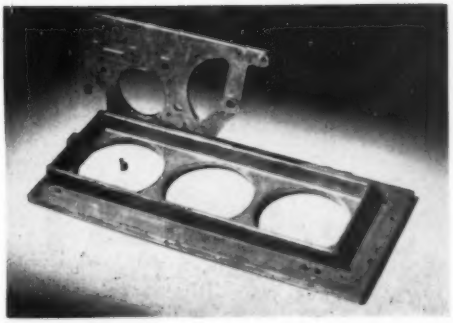
Accurately mounted within this two-piece housing are the U-shaped magnet, two pole pieces and the coil to which the recording pen is attached. Many dimensions in this assembly fall in the category of "precision" measurements, being in the order of ±.005, and one critical dimension is considerably closer.

The two pieces of the housing are: a) the flat, U-shaped base on which almost all of the components are mounted, and b) the cover which encloses and shields the device.

The more critical of these two pieces is the mounting base because it is this that determines the relative position of the electro-magnetic elements. Essential specifications include center distances between mounting holes, position



2. IMPORTANT CENTER DISTANCES are cast to ±.005 and the shoulders indicated by arrows are held much closer. Flatness, dimensions and mounting surfaces are held much closer by die casting than was possible by sand casting. Indicated at (a) is the base and (b) the cover.



3. FIXTURES FOR CLAMPING AND LOCATION were a problem when the side frames (a) and the base (b) were sand castings. All important dimensions were machined. As die cast, there are no major machining operations.

of the curved seat for the coil, and the shoulders (indicated by arrow in Figure 2) which determine the air gap.

As a sand casting, the mounting base was produced with a flat mounting surface and a crowned back, the latter for purposes of appearance. The first operation was to slab mill the entire top surface to establish a flat plane. Since the entire surface had to be slabbed, there was some problem in holding the piece, and for this purpose, small ears were cast at the edges. At best, this clamping on small areas so that the clamps would not project above the surface of the casting was unsatisfactory.

All holes were drilled, and tapped, and the outer edge of the casting was machined to match the cover casting. The large slot through which the pen arm extends had to be cut with an end mill. The mounting pad for the coil was formed separately as a plastic molding with brass inserts and assembled onto the base by screws through drilled and tapped holes.

The cover casting was equally troublesome, even though its functional use is primarily that of shielding and enclosing, rather than mounting. The rough sand casting was slab milled across mating surface at the top, and all interior surfaces were completely machined. Clamping, and locating were difficult, especially in view of the fact that flatness, perpendicular relationships and clearances for the magnet inside the cover have to be held more closely than is possible by sand casting. All interior surfaces were milled, and some holes drilled.

The heavy removal of stock made it necessary to normalize for stress relief between cuts.

Die castings eliminate all but light drill and tap operations

Probably the most noteworthy aspect of the two zinc die castings which have replaced the previous sand cast parts of the penmotor housing is the almost complete elimination of machining. Those operations which are still required are the drilling and tapping of small side holes which could only be formed by expensive pull cores. For these, drilling and tapping on a single spindle press is cheaper.

However, where holes or mounting surfaces are to be held to accurate dimensions on surfaces formed by the solid portion of the die, the castings have been held so close that no machining is required. This is true of center distances on mounting holes, held to ±.005 and to the 1⅛″ distance between locating shoulders (arrow in Figure 2) which is cast to a ±.002. It is also worth pointing out that at the request of the Brush engineering department, Accurate Die Casting Company of Cleveland who produce all of the die castings referred to here, have cast these critical locating shoulders without radius at the base angle. This has saved a straddle milling operation which would otherwise be needed.

continued on page 102

Break the Aluminum HEAT TREAT BOTTLENECK...

Specify: ALMAG 35

Minimum		Typical
35,000	Tensile	40,000
19,000	Yield	21,000
9.0	Elongation	13.0
60	Brinell	70

As Cast Properties

WARPAGE PROBLEMS ARE MINIMIZED BY THE ELIMINATION OF HEAT TREATING

Brochure on request

Military Specifications
MIL-A-10935-6-7 (QQ-M-151)

U. S. Patent Number:
2564044

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THE ECONOMY OF INVESTMENT CASTING usually comes from the casting of large numbers of small, accurate parts simultaneously by means of "trees" of patterns. This "tree" of 72 gunsight leaves is a good example of economical investment casting production.

Investment Casting Can Cut Costs:

the price of this gun sight is kept low by using investment castings

By R. WARRINGTON
Engineer
The Adapti Company

THE QUESTION is sometimes asked, "But how do investment castings compare in *cost* with other types of metal fabrications?" It is a question asked with an inflection of the voice which indicates skepticism concerning the ability of an investment casting to compete on a piece price basis, despite a general concession that parts produced by this method may be more accurate, more complex or have a better surface than otherwise possible.

AN ANSWER can best be given by example. After all, a company that is actually saving money by using an investment casting in its product is the best evidence that it can be done. A practical example that comes to mind is the leaf type gun sight manufactured by the Burton Arms Company.

All parts of this gun sight are investment cast of 1035 carbon steel by the Adapti Company of Cleveland, Ohio. The castings include the body, three leaves and the spring container.

After casting, only one machining operation is required: drilling the cross holes for the hinge pins. The assembled piece is then polished and blued and is ready to be mounted.

Gun sights of similar design have been sold in the past in the price range of $10 to $15, but the Burton Arms Company has been able to price its gun sight at $6.75, an advantage which they attribute directly to the use of investment castings produced by the "lost wax" method.

Most of this saving is derived from the reduction or elimination of secondary operations, and it has enabled the company to reach a large market of gun owners.

There are some additional advantages, accompanying the use of investment castings for these gun sights, worth noting.

- Investment casting has made it possible to introduce a small projection in each recess on the body. These projections which could not be produced by any machining method, provide a positive means of preventing dust and lint from collecting in the sight openings.
- More attractive appearance has been provided, thanks to smoother as-cast surfaces and improvement of general

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CATASTROPHE WAS AVOIDED recently when a break in the discharge line of a die casting machine flooded the zinc melting pot. A non-flammable hydraulic fluid has been credited with preventing a fire which would otherwise have occurred. Details concerning the fluid and a review of its characteristics are reported below. (Photo courtesy Smith-Johnson Corp.)

Non-Flammable Hydraulic Fluid for die casting machines, a report on properties and performance

A DRAMATIC demonstration of the effectiveness and value of non-flammable type hydraulic fluids in die casting machines inadvertantly took place several months ago at the Smith-Johnson Corporation plant at Los Angeles.

With a half dozen people watching, operator Richard Patterson was putting one of the company's machines through its paces. Suddenly the discharge line of the hydraulic system parted. Fluid, at the rate of 28 gallons a minute, sprayed the area. The operator was drenched. The zinc melting pot was flooded. But there was no flash or fire. Nor, as almost certainly would have happened if the fluid had been flammable, was there serious property damage or loss of life.

The incident emphasizes the soundness of the die casting industry's long-time interest in non-flammable type fluids as good investments. This interest and concern, part of the industry's desire to achieve the maximum in safety and efficiency, was pointed up with the presentation of the American Die Casting Institute annual Doehler Award to the three-man committee which drew up and published the Institute's Safety Manual * last year.

Few subjects are more earnestly discussed at ADCI meetings than those of safe fluids and problems of costs and maintenance related to them.

With this in mind, it might be worthwhile to take a close look at the power-transfer fluid in the machine which sprang the potentially disastrous leak at Smith-Johnson's plant. It was Pydraul F-9, Monsanto Chemical Company's non-flammable type hydraulic fluid, a phosphate ester-based material. It is not the first such fluid, nor, very likely the last. But its performance to date in some 32 plants,

* Safety Manual for the Die Casting Industry can be obtained from the American Die Casting Institute, 366 Madison Ave., New York 17, N. Y. $5.00.

TABLE I
PUMP TEST RESULTS

ACCUM. TIME (Hrs.)		F-9	0	200	400	526.8	800
		×	0	200	400		
PUMP SPEED (RPM)		F-9	.....	1200	1200	1200	1800
		×	.....	1200	1200		
PUMP PRESS. (PSI)		F-9	.....	1000	1000	1500	1500
		×	.....	1000	1000		
Pump Component Wt. Loss (gr.)	VANES (total)	F-9	37.208gm	−.002	−.010	−.016	−.016
		×	34.168	−.003	−.004		
	ROTOR RING	F-9	202.6gm	+0.4	+0.1	+0.2	0.0
		×	199.0	−0.1	−0.1		
	ROTOR	F-9	322.9gm	0.0	−0.1	−0.1	−0.1
		×	325.1	−2.9	−2.9		
	SHAFT END (Bushing)	F-9	176.982gm	+.009	−.014	−.016	−.016
		×	180.448	−.014	−.019		
	HEAD END (Bushing)	F-9	178.433gm	−.002	−.019	−.035	−.039
		×	179.831	−.015	−.017		
Condition Fluid	VIS. (cks) at 100°F.	F-9	56.8	43.0	41.3	.....	39.9
		×	64.0	62.6	62.5		
	VIS. (cks) at 210°F.	F-9	5.98	4.37	4.53	.....	4.15
		×	6.97	6.89	6.98		
	NEUT. No. mg. KOH per gr.	F-9	0.04	0.05	0.08	.....	0.18
		×	0.02	0.04	0.08		

Last 400 hours test conditions were accelerated up to 1,500 p.s.i., 1,800 r.p.m.
Note: F-9=(PYDRAUL F-9); ×=Petroleum hydraulic fluid.

including several of the largest die casting establishments, indicates that Monsanto indeed does have something.

What it is and what it is not, what it can do and what it can't aren't completely known yet. But it might be useful to see how it stacks up with the ideal non-flammable fluid which industry, particularly the die casting industry, has been seeking since hydraulic systems were first put to work. Data used is taken from a booklet describing the material recently published by Monsanto.

Flammability. The ideal fluid should be non-flammable. Pydraul F-9 resists ignition under conditions that far exceed those that would normally be encountered in use. Its autogenous ignition temperature — the temperature at which it will take fire without contact with flame—is greater than 1,100F. It does not flash, ignite or burn when subjected to standard molten metal, hot manifold, carbon, arc ignition or high and low pressure ignition tests.

A quick, practical and rule-of-thumb test for flammability, by the way, is to splash some of the material on hot metal.

Lubricity. The fluid must be its own lubricant inside the system. Pydraul F-9 has high lubricity. Its film strength determined by seizure load on a Timken machine is 17,000 psi, as compared to 5,000 psi for a good petroleum fluid. In a laboratory test with Vickers vane pump V-105A comparing Pydraul and a standard petroleum-base hydraulic fluid, Pydraul out-performed the standard fluid. Results of the test included in Table 1. Note that both the speed and pressure of the Pydraul equipped pump were stepped up twice after 400 hours. Nevertheless, the weight change, indicative of wear, was less than the margin for experimental error.

In an accelerated life test of its own, with a piston-type pump at 2,000 psi, the Vickers Company reported results indicating no more than normal wear.

Low volatility. The fluid should evaporate slowly, preferably not at all, when in use. Tests run in accordance with Army-Navy specifications for determining evaporation under accelerated conditions showed that the Monsanto material, with a 3 percent loss, is well within limitations.

Viscosity. The ideal fluid should have the optimum viscosity for whatever temperature is best for operation of the system. It should, in addition, undergo small changes of viscosity with changes in temperature. Viscosity characteristics of the non-flammable fluid are almost identical with those of a medium grade petroleum-base hydraulic fluid and it is highly mobile, even at the lowest temperatures normally encountered in machine operation. Laboratory data, based on tests in accordance with ASTM procedures, are shown in Table 2. In actual use, the fluid has given excellent performance in die casting machines, hydraulic riveting machines and punches, furnace door actuators, and so on.

Noncorrosiveness. There should be a minimum of reaction with the metallic and nonmetallic parts of the system, including

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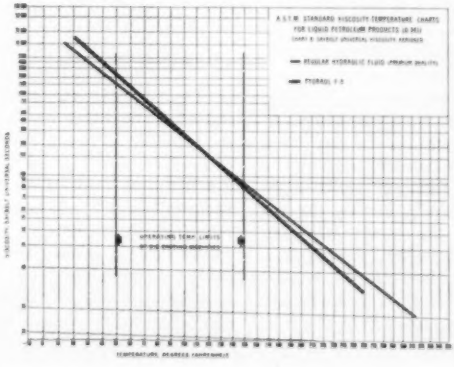
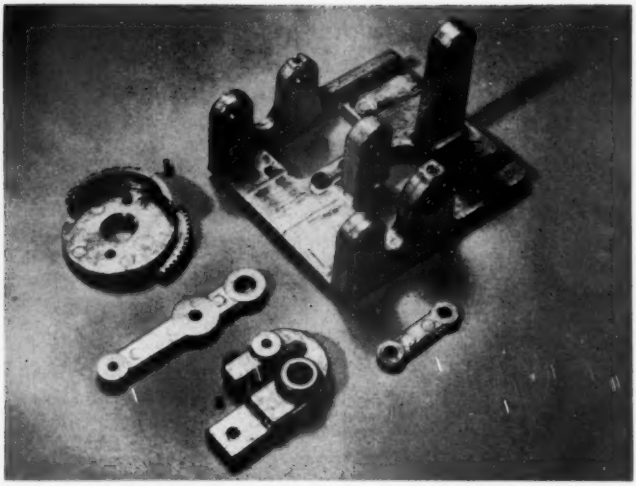
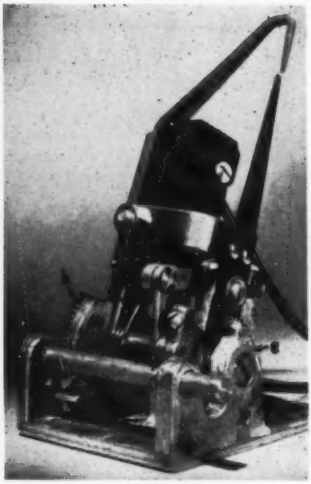
TABLE II
VISCOSITY CHARACTERISTICS





ADJUSTMENT IS ACCOMPLISHED by means of the screw in the U-shaped die cast link (a). Brake drum with segment gear (b), mounting base (c) and two simple links are also shown.



AS ASSEMBLED, the three key die cast zinc components are indicated above.

ELASTIC PROPERTIES of zinc

die castings are useful for adjustable parts

IN a part where the elastic properties of a metal must be employed, the possibility of using die cast zinc is sometimes overlooked. An application which makes successful use of the elasticity of a zinc die casting is in the fine adjustment of the temperature indicating controller illustrated.

This indicating controller, made by the Partlow Corp., of New Hartford, N. Y., has, as a temperature sensing element, a standard mercury bulb connected to the indicating instrument with the usual mercury filled flexible tube. Through a system of levers, the movement of the mercury is transferred to movement of the indicator hand. This lever system has a multiplication factor such that a movement of about 0.125 inches at the head of the column will move the indicator hand through the segment of a circle with an included angle of 47 to 60 degrees, depending upon the temperature range of the instrument.

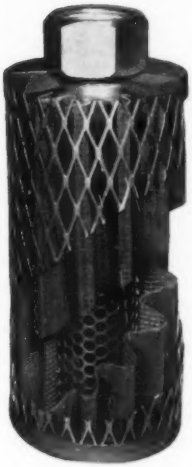
A portion of the lever is the "U" shaped die casting shown in Figure 1a. This piece is designed so that one leg is used to mount the indicator hand and the other one connects to the multiplying system of the instrument. The space between the two legs is varied by the machine screws within the elastic limits of the metal.

When a gross adjustment for temperature has been made by means of the adjustable link that fits into the flexible tube, the fine adjustment can be made by changing the gap between the two legs of the "U" link. Since the ratio of the radii, from the common center to the adjusting screw in one case and to the end of the pointer in the other case is about 8 to 1, a change of chord length of only a few thousandths of an inch at the screw is enough to give a relatively large change of arc length at the tip of the pointer.

This use of a die casting has proven its reliability over extended field service periods. This and other die castings used in

continued on page 108

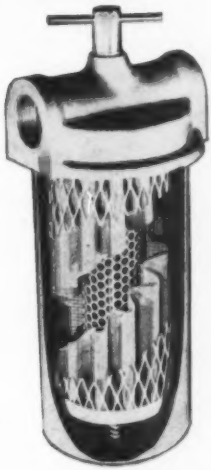
OVER 270 MANUFACTURERS OF PRODUCTION MACHINES



Sump Type (cutaway)

equip
their products
with

MARVEL SYNCLINAL FILTERS



Line Type (cutaway)

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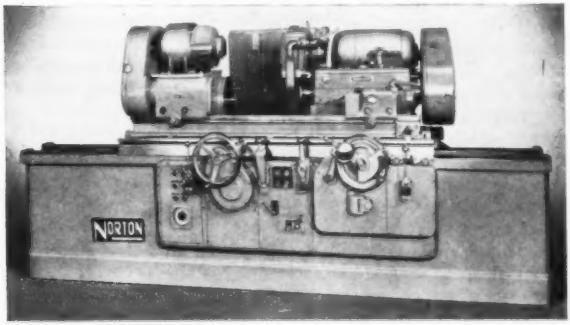

NORTON 10" CTU CYLINDRICAL GRINDING MACHINE. "Marvels" do their share in keeping liquids clear of foreign matter in this and other machines produced by the Norton Company.—Photo courtesy Norton Company, Worcester, Mass.

Available in both sump and line type models. Individual capacities from 5 to 50 g.p.m. and mesh sizes from 30 to 200. Multiple installation provides greater capacity as you may require. Line models easily removed without disturbing pipe fittings. For efficient cleansing of non-corrosive liquids in all hydraulic and low pressure systems Marvel has your answer.

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PROTOTYPE DIE CASTINGS PRODUCED BY INVESTMENT CASTING for preliminary testing and study

1. TO HELP IN STYLING, this interior door handle for an automobile was first investment cast to obtain prototypes, to permit final design changes before sinking the die casting die cavity. Note that the feeder for the casting has not been removed.

THERE are at least three reasons why buyers of die castings might sometimes find it desirable to have prototypes produced in metal before the design of the castings becomes finalized and the actual die construction started.

- Performance testing of trial castings in the alloy to be die cast would permit adjustments in detail before the dies are built;
- Different alloys could be compared for serviceability, appearance, sales, etc.
- Advance pieces could be procured to be assembled into display or trade show models before actual production gets under way.

Since the design of a part is "frozen" by virtue of being translated into a steel die cavity, the opportunity to have an advance casting to circumvent subsequent alterations in the die bears such obvious advantage that product designers have often gone to considerable effort to have accurate prototype models fabricated. Model makers have most commonly machined these from rough sand castings or built them up from elements machined from the bar or formed from sheet and rod.

These techniques have had certain disadvantages, most significant of which is that their resemblance to the actual die casting is only superficial, and does not give a satisfactory prototype for testing, materials selection, appearance or production analysis.

One method of producing prototype die castings that has been used successfully within the past few years by certain of the major auto builders is the investment casting process.

Each of the examples cited here is a part designed for production as a die casting and given a preliminary sample run by investment casting by the Kerr Manufacturing Company of Detroit.

It must be conceded at the outset that piece prices for small quantities ranging generally from 50 to 200 samples, is many times higher than the piece price of production quantities; investment casting, like other casting processes, becomes more economical with an increase in quantity output. However, the money spent on such prototype pieces is repaid many times in savings on subsequent die costs, in improvements in mechanical details, in production shortcuts which become apparent when the three-dimensional sample is in hand, and in many other ways.

Model of the part must be supplied

The investment caster who produces such prototype die castings prefers to work from a print of the part. He usually marks up the print to compensate for pattern and metal shrinkages, and then returns the print to the customer so that the master model can be made to the dimensions suggested.

Brass master models are preferred; however, models can be formed in hard wood, plaster, or other easily worked materials. The only limitation on the ma-

2. TO HELP IN SELECTING AN ALLOY, the automotive lock part (left) was investment cast in three different alloys. When engineering tests had been run, a zinc alloy was selected. Other investment castings illustrated were also produced for engineering tests, even though ultimate production was to be by die casting.

teral being that it must withstand the temperature of the synthetic rubber or low-fusing point metals which are used to make the molds.

At the Kerr Manufacturing Company, a synthetic rubber is used, which is called Nuplamold. This product was developed by, and is available from the New Plastics Corporation, 1017 N. Sycamore Ave., Hollywood, California. Synthetic rubber can also be used very satisfactorily, and permits certain economizing. Thus, if a metal mold rather than the rubber mold, were to be used for producing wax patterns, no undercuts could be tolerated, and considerable side coring would be required, since die castings very often have recesses and reentrant angles formed by core pulls and slides.

Using a rubber mold, the pattern for the investment casting is cast in a non-shrinking wax, also developed by Kerr, and the mold has sufficient resiliency to permit stripping away from undercuts or small recesses.

In some cases, where greater accuracy of dimension than can be achieved with rubber mold is required, a metal mold can be used, and Kerr pattern wax is preferred especially where there are thin edges or fragile details to be reproduced. This adds somewhat to the initial piece cost, but also reduces subsequent manual finishing. The choice of die materials depends entirely upon such factors as the presence of undercuts, the amount of surface detail desired, the degree of accuracy, and similar considerations.

Investment castings can be produced in any of the commonly used die casting alloys, and the examples presented here include zinc, aluminum and brass.

3. ELECTRIC SHAVER PARTS were tried in brass and aluminum before selecting aluminum as the die casting alloy.

Automobile door handle investment cast to help in styling

It is a well-known fact that styling plays a major part in automobile sales, and the closest attention is paid to the decorative die castings which compose automotive trim and supply those essential accents.

An inside door handle, Figure 1, was investment cast in the same zinc alloy as was used ultimately for the production die castings. The casting shown here is as cast, without having the gate removed.

Previously, door handles were produced in sample lots for the styling department by sand casting them, and then spending many hours of skilled pattern makers' time in finishing. Now the handles are used as cast, with only a polishing and plating operation.

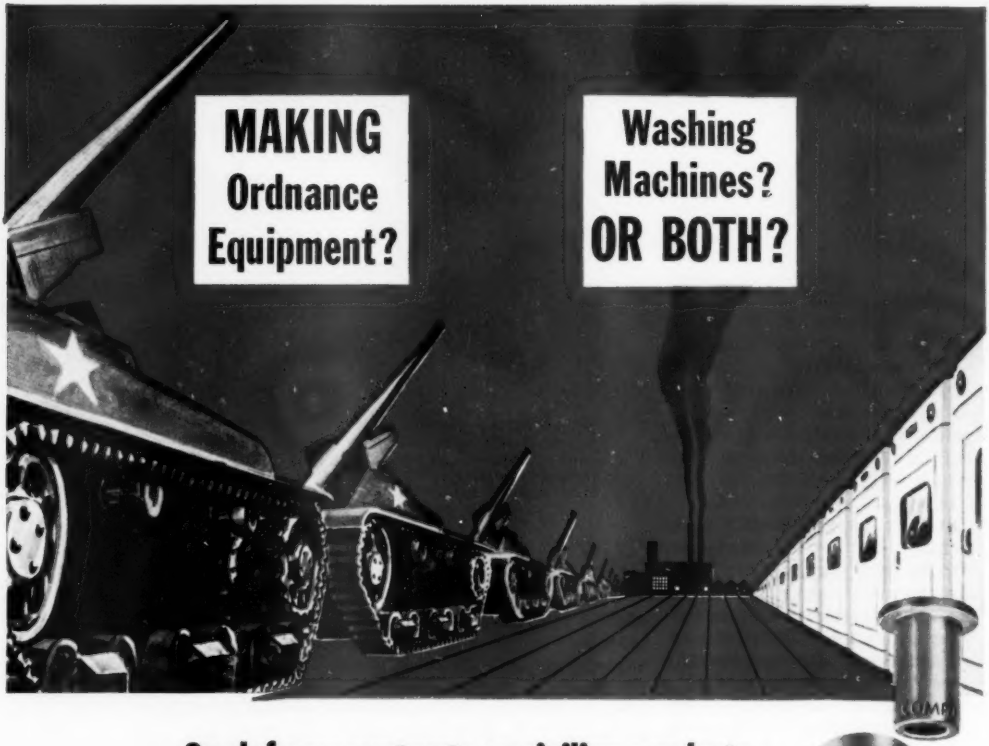
Both inside and outside door handles were produced by this method, and not only had close resemblance to the appearance of the die castings, but were also close enough metallurgically to permit engineering tests. Both samples were subsequently put into production as die castings.

Lock parts cast in three alloys

Three parts for automobile locks, Figure 2, were investment cast for a producer of automotive die castings. These are all primarily engineering test models, and one of them was utilized to aid in choosing an alloy.

The component indicated in Figure 2, was investment cast in brass and in two zinc alloys. These parts were then given thorough testing by the customer, and one of the zinc alloys was chosen for final die casting production.

continued on page 100



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A Directory Of
THE POWDER METALLURGY INDUSTRY

Components Fabricators; Powder Producers; Equipment Builders

FOR AN ALPHABETICAL LISTING TURN TO PAGE 71

COMPONENTS FABRICATORS

BEARINGS
Copper or iron base

American Sintered Alloys Inc.
Bethel, Conn.

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metal Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products Co.
P. O. Box 129
Ellwood City, Pa.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Pressco Powdered Parts Corp.
523 West Ave.
Norwalk, Conn.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

U. S. Graphite Co.
1621 Holland Ave.
Saginaw, Mich.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

BEARINGS
Other (type)

American Electro Metal Corp.
320 Yonkers Ave.
Yonkers 2, N. Y.
(Special with Moly-disulfide)

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.
(Stainless steel; aluminum)

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks Inc.
516 E. Santa Ana St.
Anaheim, Calif.
(brass)

Micro Metallic Corp.
30 Sea Cliff Ave.
Glen Cove, N. Y.
(Stellite)

CONTACT MATERIALS
Pure metals (platinum, silver, etc.)

Fansteel Metallurgical Corp.
North Chicago, Ill.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

CONTACT MATERIALS
Tungsten copper, tungsten silver, etc.

American Electro Metal Corp.
320 Yonkers Ave.
Yonkers 2, N. Y.

Fansteel Metallurgical Corp.
North Chicago, Ill.

Speer Carbon Co.
P. O. Box 433
St. Marys, Pa.

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

CORES
High frequency

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Speer Carbon Co.
P. O. Box 433
St. Marys, Pa.

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

CORES
Low frequency

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

ELECTRICAL COMPONENTS
Carbon brushes

Stackpole Carbon Co.
Tannery St.
St. Marys, Pa.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Speer Carbon Co.
P. O. Box 433
St. Marys, Pa.

ELECTRICAL COMPONENTS
Collector rings

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

ELECTRICAL COMPONENTS
Commutator segments

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

ELECTRICAL COMPONENTS
Pole pieces

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metal Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

ELECTRICAL COMPONENTS
Rotor segments

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

FRICTION MATERIALS

General Metals Powder Co.
130 Elinor Ave.
Akron 5, O.
(Clutch and brake)

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.
(Metallic)

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.
(metal powder, semi-metallic, non-metallic)

S. K. Wellman Co.
1374 E. 71st St.
Cleveland 3, O.
(Clutch and brake)

Wel-Met Co.
110 Gougler Ave.
Kent, O.
(metallic bronze)

MAGNETIC MATERIALS, HARD
(Alnico type)

Indiana Steel Products Co.
Valparaiso, Ind.

MAGNETIC MATERIALS, HARD

Henry L. Crowley
1 Central Ave.
West Orange, N. J.
(Croloy)

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.
(Cobalt magnets, moly-iron, special permanent magnets)

Wel-Met Co.
110 Gougler Ave.
Kent, O.

MAGNETIC MATERIALS, SOFT

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.
(Magnetic materials, iron, nickel)

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

MAGNETIC MATERIALS
Iron silicon, soft

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

MISCELLANEOUS

Fansteel Metallurgical Corp.
North Chicago, Ill.
(High density parts, rotors, counterweights, etc.)

Micro Metallic Corp.
30 Sea Cliff Ave.
Glen Cove, N. Y.
(Stainless steel filters)

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.
(Ceramic types, ferrites)

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.
(Bronze filters)

Wel-Met Co.
110 Gougler Ave.
Kent, O.
(Bronze filters)

STRUCTURAL PARTS
Brass

American Sintered Alloys Inc.
Bethel, Conn.

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products Co.
P. O. Box 129
Ellwood City, Pa.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

STRUCTURAL PARTS
Copper Base

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

American Sintered Alloys Inc.
Bethel, Conn.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
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Kwikset Locks, Inc.
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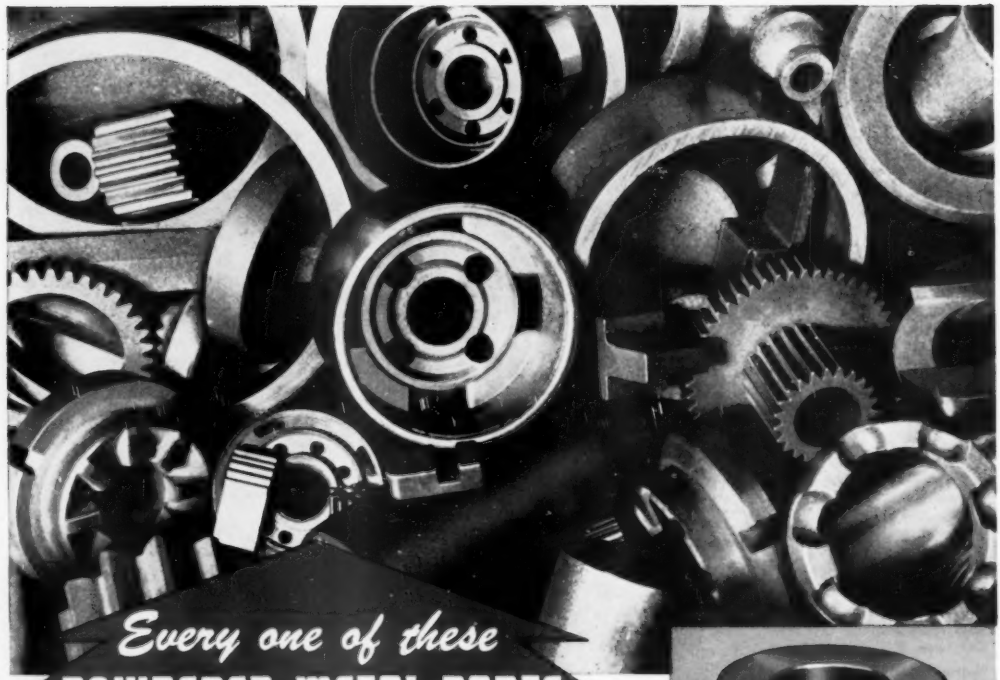

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has cut a product's cost

Wherever parts produced by Michigan Powdered Metal Products Company are being used, tremendous savings have been made in assembled finished products. Here *all* the advantages of powder metallurgy are realized. Machining and finishing operations are eliminated on simple and highly complicated parts alike. Combinations of materials not otherwise obtainable are employed. Porosity or density can be controlled to meet specific requirements; and dimensional accuracy and good surface finish are regularly provided.

As one of the pioneers in the field of powder metallurgy, Michigan Powdered Metal Products Company today has the experience and facilities to produce parts never before considered for manufacture by this process. It will pay you to investigate what we can do for you. We will be glad to submit quotations based on your part prints and specifications—promptly, and without obligation on your part.

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OIL-WELL BEARINGS

. . . exclusive, patented products of Michigan Powdered Metal Products Company. In these bearings, a cavity of uniform size is formed in the center of the bearing wall. As grease or oil is impregnated into the sintered metal, it fills this cavity as well as the pores in the sintered metal body itself—providing much greater oil content than in conventional bearings of this type. They are produced only on a contract basis. Full information upon request.

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474 CADY STREET • NORTHVILLE, MICHIGAN

A Wholly-Owned Subsidiary of ALLIED PRODUCTS CORPORATION

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417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products Co.
P. O. Box 129
Ellwood City, Pa.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Pressco Powdered Parts Corp.
523 West Ave.
Norwalk, Conn.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

U. S. Graphite Co.
1621 Holland Ave.
Saginaw, Mich.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

STRUCTURAL PARTS
Iron base, low density

American Sintered Alloys Inc.
Bethel, Conn.

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

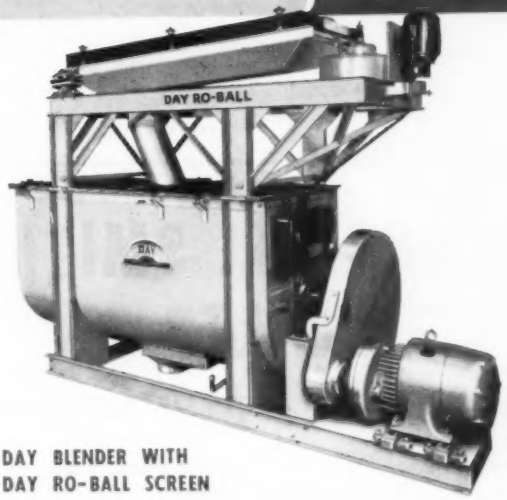
Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Cal'f.

ACCURATE SIZING
PROPER DENSITY
THOROUGH BLENDING

Successful Powder Metallurgy



DAY BLENDER WITH
DAY RO-BALL SCREEN

Successful powder metallurgy depends on accurate sizing of metal particles, proper density of the compact and thorough blending to insure homogeneous structure. The DAY Blender, teamed with the DAY Ro-Ball Screen, meets all three of these vital requirements.

The DAY Blender's sturdy construction features heavy channel legs, outboard bearings and stuffing boxes and a rugged tank of plain, galvanized or stainless steel. Dependable drive is provided by a heavy-duty geared motor. Center discharge is standard.

The DAY Ro-Ball employs the exclusive Super-Active Ball Cleaning principle for evenly distributed vibration over the entire screen area. This design permits use of finer mesh and keeps the screen open for fast, efficient operation.

DAY DRY COLOR AGITATOR

Rugged construction, scientifically designed for thorough radial and two-way lateral mixing action. Available in plain, galvanized or stainless steel.

For specific applications ask about DAY'S complete line of Double-Arm Mixers, Blenders, and Change-Can Mixers.

DAY

Call your DAY Sales Engineer or write to 1146A Harrison Avenue for detailed literature.

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INCORPORATED

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Jamaica Plain, Boston 30, Mass.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products Co.
P. O. Box 129
Ellwood City, Pa.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Pressco Powdered Metal Parts Corp.
523 West Ave.
Norwalk, Conn.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

U. S. Graphite Co.
1621 Holland Ave.
Saginaw, Mich.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

STRUCTURAL PARTS
Iron base, high density, copper free

American Sintered Alloys Inc.
Bethel, Conn.

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Pressco Powdered Metal Parts Corp.
523 West Ave.
Norwalk, Conn.

Pyro Ferric Co.
621 E. 216th St.
New York 67, N. Y.

Radio Cores Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

U. S. Graphite Co.
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Saginaw, Mich.

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.

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350 MINUS TO 2200 MINUS

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Michigan 9256

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STRUCTURAL PARTS
Iron base, high density, copper impregnated

American Sintered Alloys Inc.
Bethel, Conn.

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Chicago Powdered Metal Prod. Co.
9341 Irving Park Rd.
Schiller Park, Ill.

Henry L. Crowley
1 Central Ave.
West Orange, N. J.

Detroit Sintered Metals Corp.
18434 Fitzpatrick Ave.
Detroit 28, Mich.

Keystone Carbon Co.
State St.
St. Marys, Pa.

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.

Metal Powder Products, Inc.
417 W. Fifth St.
Dayton, O.

Michigan Powdered Metal Products Co., Inc.
456 E. Cady St.
Northville, Mich.

Moraine Products Div.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Franklin Park, Ill.

Precision Metal Products Co.
P. O. Box 126
Ellwood City, Pa.

Pressco Powdered Metal Parts Corp.
523 West Ave.
Norwalk, Conn.

Presmet Corp.
112 Harding St.
Worcester, Mass.

Radio Cores, Inc.
9540 Tulley Ave.
Oak Lawn, Ill.

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.

Thompson Products Inc.
Metro Div.
23555 Euclid Ave.
Cleveland 17, O.

Waterbury Companies, Inc.
835 S. Main St.
Waterbury 20, Conn.

Wel-Met Co.
110 Gougler Ave.
Kent, O.

STRUCTURAL PARTS
Other

Amplex Mfg. Co.
P. O. Box 2718
Detroit 31, Mich.
(Stainless steel)

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ELECTROLYTIC COPPER POWDERS

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THE AMERICAN METAL Co., Ltd.

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SCREENED ACCURATELY on **EXOLON** *Multi-Deck* VIBRATING SCREENS —TEN REASONS WHY THEY'RE BETTER

CHECK THESE ***Practical Advantages***

1. CLOSE, ACCURATE GRADING because every inch of every screen is used.
2. SEVERAL SIZES PRODUCED in one operation.
3. MINIMUM FLOOR SPACE required . . . Standard model occupies 28 sq. ft.
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Tonawanda, New York

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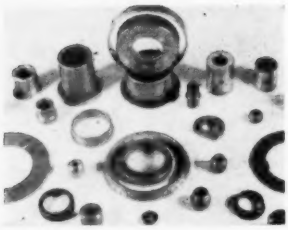
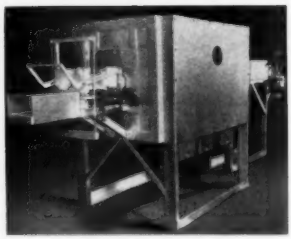


POWDERED METAL PARTS

Quickly & Economically Sintered in

Harper

Electric FURNACES



Model HOU-8156-MI-21 Harper Electric Furnace with cooling chamber for sintering, brazing, and annealing operations. Parts to be treated are charged and discharged manually in this alloy muffle furnace with water-cooled exit chamber. Simple sturdy construction of this unit, providing economy of atmosphere allows for maximum working at low investment cost.

Whether your heat treating requirements call for research or production units you will want to investigate the versatile features of Harper Electric furnaces for sintering metal powder products and other processes.

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★ Flexible design permits variation and duplication of heating cycles.

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(Nickel Silver)

Keystone Carbon Co.
State St.
St. Marys, Pa.
(Stainless steel & aluminum)

Kwikset Locks, Inc.
516 E. Santa Ana St.
Anaheim, Calif.
(Bronze filters)

Merriman Bros., Inc.
185 Amory St.
Jamaica Plain, Boston 30, Mass.
(Helical gears)

Powdered Metal Products Corp. of America
9335 W. Belmont Ave.
Fronklin Park, Ill.
(Nickel base alloys)

Radio Cores, Inc.
9540 Tulley Ave.
Oak Lawn, Ill.
(Cobalt, molybdenum)

Sintered Metals, Inc.
3399 Washington St.
Boston 30, Mass.
(Nickel Silver)

Thompson Products Inc.
Metro D'v.
23555 Euclid Ave.
Cleveland 17, O.
(Stainless steel)

U. S. Graphite Co.
1621 Holland Ave.
Saginaw, Mich.
(Nickel, silver, & bronze)

Waterbury Companies Inc.
835 S. Main St.
Waterbury 20, Conn.
(Silver, silver oxide, nickel)

Wel-Met Co.
110 Gougler Ave.
Kent, O.
(German silver)

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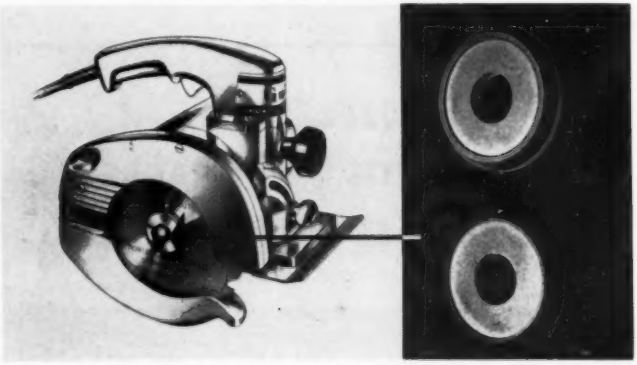
Chicago 3, Ill.

Drever Co.
736 E. Venango St.
Philadelphia 34, Pa.

Harper Electric Furnace Corp.
39 River St.
Buffalo 2, N. Y.



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IPM

International Powder Metallurgy Co.

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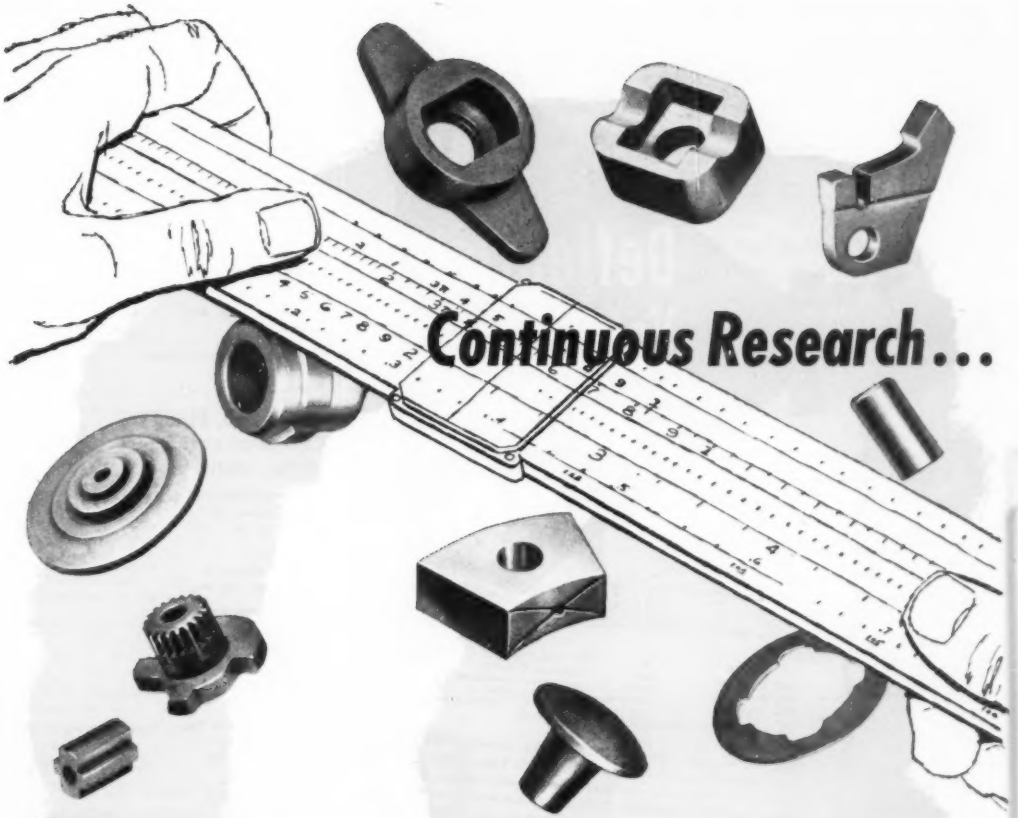

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Continuously Wider Benefits!

An important part of Moraine's operations is a continuous program of engineering research and production improvements.

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Moraine has demonstrated to many industries its ability to produce metal powder parts for them . . . faster and at lowered costs.

Metal Powder Parts by Moraine

MORAINE PRODUCTS DIVISION OF GENERAL MOTORS DAYTON, OHIO

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TOROID
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PLAIN CORE
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B
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DYC 3 : 2.054 .960*
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*Lengths vary upon individual requirements.
You can now get high permeability flake-iron deflection yoke cores for as low as thirty cents a pair. These deflection yoke cores are the results of our continuing powdered metal engineering research. You get a deflection yoke core produced from a combination of the latest powdered metal molding techniques, using an entirely new development of flake iron powder.
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Design and Manufacture—select one of our standard flake-iron deflection yoke cores for your needs. They are designed to meet the highest electronic and mechanical standards of deflection yoke coils. If one of our standard deflection yoke cores cannot meet your mechanical needs, we will submit samples and designs that will.*
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Providence 5, R. I.

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Pereny Equipment Co.
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Pittsburgh 2, Pa.

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American Gas Furnace Co.
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Continental Industrial Engineers, Inc.
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Drever Co.
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Eclipse Fuel Engineering
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Rockford, Ill.

Holcroft & Co.
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Surface Combustion Corp.
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Controlled atmosphere, metal muffle, batch

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Lindberg Engineering Co.
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Chicago 12, Ill.

Sunbeam Corp.
4433 W. Ogden Ave.
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Westinghouse Electric Corp.
Box 868
Pittsburgh 2, Pa.

FURNACES, ELECTRIC
Controlled atmosphere, metal muffle, continuous

Continental Industrial Engineers, Inc.
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Drever Co.
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Philadelphia 34, Pa.

Electric Furnace Co.
Wilson, St.
Salem, O.

Harper Electric Furnace Corp.
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Buffalo 2, N. Y.

C. I. Hayes, Inc.
75 Baker St.
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Hevi Duty Electric Co.
P. O. Box 563
Milwaukee 1, Wisc.

Holcroft & Co.
6545 Epworth Blvd.
Detroit 10, Mich.

Lindberg Engineering Co.
2450 W. Hubbard St.
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Westinghouse Electric Corp.
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Pittsburgh 2, Pa.

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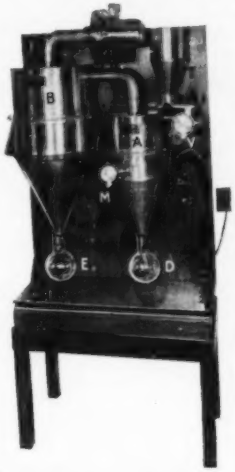
FOR METALLIC POWDERS



If your company produces or purchases metallic powders, then time required to inspect Federal Unit B in our laboratory will be well spent. This instrument, powered from light socket, handles powders of any density, taking feed of 120 pounds per hour. Efficient at 5 microns.

In the separation of pulverized materials, no similar device on the market will duplicate results or earn equal profits. Repeat orders received for extra units and spare parts make positive proof of efficiency.

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EF

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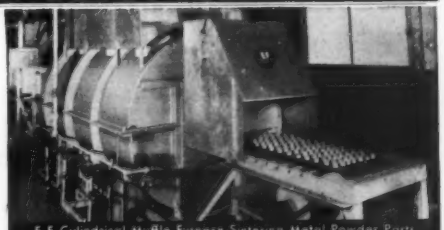
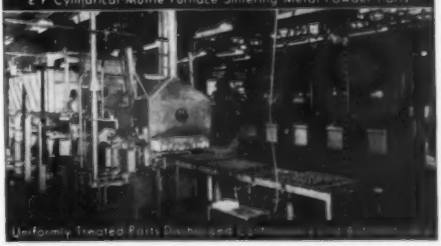

E F Cylindrical Muffle Furnace Sintering Metal Powder Parts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● EF furnaces are built in many sizes and types for sintering a wide variety of ferrous and non-ferrous pressed metal powder products — for bonding metal powder to strip, and other processes.

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Detroit 10, Mich.

Surface Combustion Corp.
Toledo 1, O.

Westinghouse Electric Corp.
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Pittsburg 2, Pa.

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Controlled atmosphere, metal muffle, batch

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Elizabeth, N. J.

Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Drever Co.
736 E. Venango St.
Philadelphia 34, Pa.

Eclipse Fuel Engineering Co.
1100 Buchanan
Rockford, Ill.

Electric Furnace Co.
Wilson, St.
Salem, O.

Holcroft & Co.
6545 Epworth Blvd.
Detroit 10, Mich.

Lindberg Engineering Co.
2450 W. Hubbard St.
Chicago 12, Ill.

Sunbeam Corp.
4433 W. Ogden Ave.
Chicago 23, Ill.

Surface Combustion Corp.
Toledo 1, O.

Westinghouse Electric Corp.
Box 868
Pittsburgh 2, Pa.

FURNACES, GAS OR OIL FIRED
Controlled atmosphere, metal muffle, continuous

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116 Spring St.
Elizabeth, N. J.

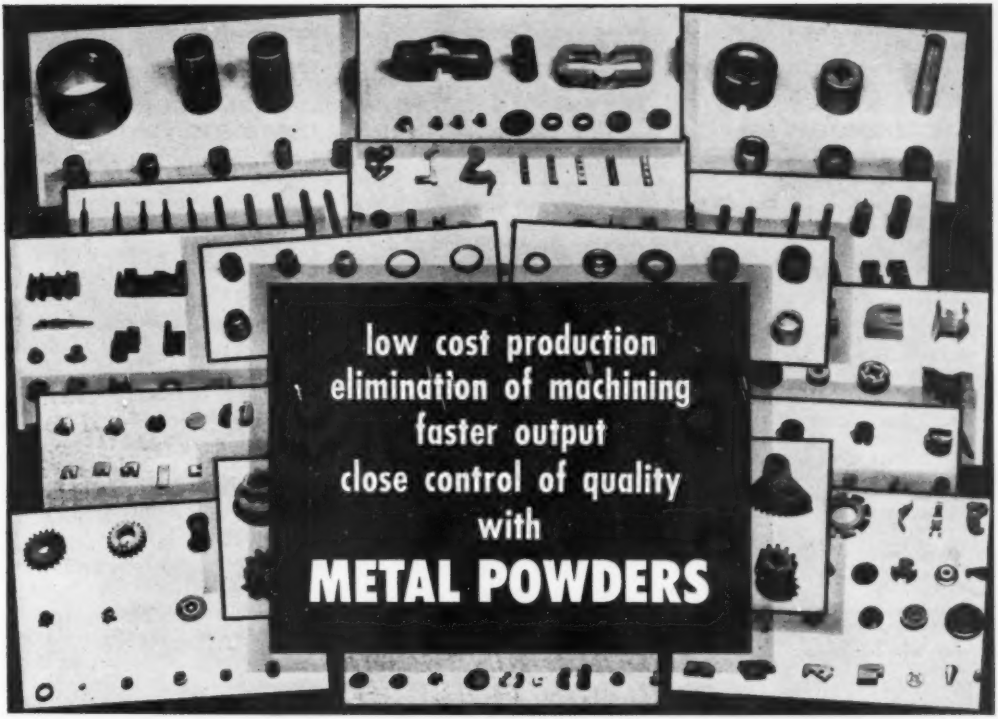
Continental Industrial Engineers, Inc.
176 W. Adams St.
Chicago 3, Ill.

Drever Co.
736 E. Venango St.
Philadelphia 34, Pa.

Electric Furnace Co.
Wilson, St.
Salem, O.

Holcroft & Co.
6545 Epworth Blvd.
Detroit 10, Mich.

Lindberg Engineering Co.
2450 W. Hubbard St.
Chicago 12, Ill.



Plastic Metals, with 18 years experience in the development of metal powders, is one of the leading suppliers of this important material to metal powder part fabricators. A continuous expansion program has provided facilities having capacities adequate to meet the constantly increasing demands for the metal powders listed below:

PLAST-IRON—a high quality electrolytic iron powder of extreme purity—ideally suited for electrical, magnetic and high physical property applications.

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If you are manufacturing parts for military materiel—or for any civilian product where metal shortages are causing production problems—we shall be glad to put you in touch with qualified metal powder part fabricators for a discussion of the practical possibilities of metal powders for your specific needs.

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The Metal Powder Association Meeting
Drake Hotel
Chicago, April 29-30, 1952

PLASTIC METALS

DIVISION OF THE NATIONAL RADIATOR COMPANY
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Philadelphia 34, Pa.

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Salem, O.

C. I. Hayes, Inc.
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Lindberg Engineering Co.
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Chicago 12, Ill.

Surface Combustion Corp.
Toledo 1, O.

Westinghouse Electric Corp.
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Pittsburgh 2, Pa.

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Philadelphia 34, Pa.

Electric Furnace Co.
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Salem, O.

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Hevi Duty Electric Co.
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Detroit 10, Mich.

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Lindberg Engineering Co.
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Chicago 12, Ill.

Surface Combustion Corp.
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Philadelphia 34, Pa.

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Rockford, Ill.

Electric Furnace Co.
Wilson, St.
Salem, Ohio

C. I. Hayes, Inc.
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Providence 5, R. I.

Hevi Duty Electric Co.
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Milwaukee 1, Wisc.

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Ozark-Mahoning Co.
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Wilson St.
Salem, O.

Hevi Duty Electric Co.
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Milwaukee 1, Wisc.

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Toledo 1, O.

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Carbonyl Iron Powder is an extremely pure form of iron, the metal content being over 99.99% iron, produced in the form of almost perfect spheres only one to fifteen microns in diameter—the average diameter being 8 microns (.00032 inches). It has been produced commercially for some years, primarily for use in magnetic cores for electronic equipment. Its production is therefore now under perfect control to give absolute reliability in quality and properties.

The production of Iron Carbonyl, from which Carbonyl Iron Powders are made, depends on a unique reaction, which was discovered in 1890 by the distinguished British chemist, Sir Ludwig Mond. When iron is treated with carbon monoxide it reacts to form iron pentacarbonyl, a rare case of a liquid compound of a metal. Each atom of iron combines with five molecules of carbon monoxide to give a compound with the formula $Fe(CO)_5$. This reaction leaves behind any impurities in the original iron.

This liquid is vaporized and the vapor heated above 200°C, when it decomposes into its constituents. The carbon monoxide is driven off and the iron separates from the vapor phase, first in the form of free atoms, then as ultramicroscopic crystals, finally as microscopic, almost perfect spheres. The particle size distribution can be controlled by temperature, pressure and other operating conditions.

Controlled purity and distribution of particle size is essential for use of the powder in electronics, where minor variations in these properties have exaggerated consequences in delicate electrical and magnetic effects.

The only other elements present are non-metals such as carbon, oxygen and nitrogen. In G A & F Carbonyl Iron Powder, they amount to not more than 0.8% carbon, 0.9% oxygen and 0.7% nitrogen.

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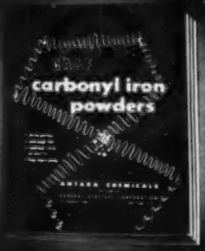

...the technical portrait of an unusual product

The first large-scale production of Iron Carbonyl was undertaken in Germany shortly after 1920. By 1928 the process had been adapted to the continuous commercial production of Carbonyl Iron Powder. Subsequently, detailed studies and meticulous laboratory-type controls in the plant permitted accurate regulation of purity and particle size for the needs of the modern electronic industry.

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J. H. Day Co., Inc.
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Cincinnati 22, O.

General Mixing Equipment Co.
413 N. Third St.
Philadelphia 23, Pa.

Industrial Process Engineers
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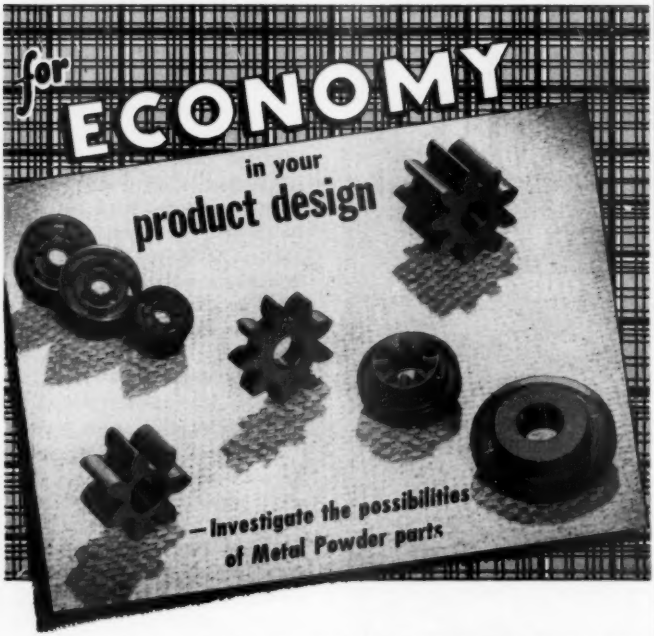

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Arthur Colton Co.
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Detroit 7, Mich.

Dorr-Paterson Engineering Co.
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Detroit 7, Mich.

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Chicago, Ill.

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Metals Disintegrating Co.
Box 290
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New Jersey Zinc Co.
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Antara Chemical Div.
General Dyestuffs Corp.
435 W. Hudson St.
New York 14, N. Y.
(Carbonyl iron only)

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Paul Blum Co.
315 Larkin St.
Buffalo 10, N. Y.

Ekstrand & Tholand, Inc.
441 Lexington Ave.
New York, N. Y.

Ferrum, Ltd.
106 Ste. Madeleine Bld.
Cap de la Madeleine
Quebec, Can.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Hoeganaes Sponge Iron Corp.
545 Fifth Ave.
New York 17, N. Y.

Magnetic Powders, Inc.
Fairview Ave.
Johnsonburg, Pa.

Metal Powders, Rgd.
Iberville, Quebec, Can.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.

Plastic Metals Div.
National Radiator Corp.
Johnstown, Pa.

Pyron Corp.
P. O. Box 246, LaSalle Sta.
Niagara Falls, N. Y.

George R. Smith Co., Ltd.
448 S. Hill St.
Los Angeles 13, Cal.

Ventures, Ltd.
Toronto
Ontario, Can.

LEAD

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Glidden Company
Chemical & Pigment Div.
Hammond, Ind.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

National Lead Co.
111 Broadway
New York 6, N. Y.

NICKEL

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

Plastic Metals Div.
National Radiator Corp.
Johnstown, Pa.

STEEL

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Ferrum Ltd.
Cap de la Madeleine
Quebec, Can.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Plastic Metals Div.
National Radiator Corp.
Johnstown, Pa.

Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.

TIN

American Metals Co., Ltd.
61 Broadway
New York, N. Y.

continued on page 76

Welcome...

to the 1952 METAL POWDER SHOW

...and Eighth Annual Meeting of the Metal Powder Association

APRIL 29th and 30th • CHICAGO, ILL.

from **...The Chemicals–Pigments–Metals Division of The Glidden Company**

QUALITY **Glidden** PRODUCTS

VISIT SPACE **26**

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Lead Powder

Cubond, Copper Brazing Paste

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For additional information circle No. 38 on the Reader Service Card

ALPHABETICAL LISTING—By group

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AMERICAN ELECTRO METAL CORP.
320 Yonkers Ave.
Yonkers 2, N. Y.
(Bearings; (special) structural parts; (high temperature cores; (specials) magnetic materials)

AMERICAN SINTERED ALLOYS, INC.
Bethel, Conn.
(Bearings; structural parts)

AMPLEX MFG. CO.
P. O. Box 2718
Detroit 31, Mich.
(Bearings; structural parts, cores, magnetic materials, friction materials, filters, electrical components)

BOUND BROOK OIL-LESS BEARING CO.
Bound Brook, N. J.
(Bearings; structural parts, electrical components)

CHICAGO POWDERED METAL PRODUCTS CO.
9341 Irving Park Rd.
Schiller Park Ill.
(Bearings; structural parts, electrical components)

HENRY L. CROWLEY
1 Central Ave.
West Orange, N. J.
(Bearings; structural parts, cores; magnetic materials; electrical components)

DETROIT SINTERED METAL CORP.
18434 Fitzpatrick Ave.
Detroit 28, Mich.
(Bearings; structural parts, electrical components)

FANSTEEL METALLURGICAL CORP.
North Chicago, Ill.
(Contact materials, high density parts (rotors, counterweights, etc.)

GENERAL METALS POWDER CO.
130 Elinor Ave.
Akron 5, O.
(Clutch and brake friction materials)

INDIANA STEEL PRODUCTS CO.
Valparaiso, Ind.
(Magnetic materials)

KEYSTONE CARBON CO.
State St.
St. Marys, Pa.
(Bearings, structural parts; contact materials; electrical components)

KWIKSET LOCKS, INC.
516 E. Santa Ana St.
Anaheim, Calif.
(Bearings; structural parts; bronze filters)

MERRIMAN BROS., INC.
185 Amory St.
Jamaica Plain, Boston 30, Mass.
(Structural parts; helical gears; magnetic materials; electrical components)

METAL POWDER PRODUCTS, INC.
417 W. Fifth St.
Dayton, Ohio
(Bearings; structural parts; friction materials —metallic; electrical components)

MICHIGAN POWDERED METAL PRODUCTS CO., INC.
456 E. Cady St.
Northville, Mich.
Bearings; structural parts; electrical components)

MICRO METALLIC CORP.
30 Sea Cliff Ave.
Glen Cove, N. Y.
(Bearings—Stellite; stainless steel filters)

MORAINE PRODUCTS DIV.
General Motors Corp.
1420 Wisconsin Blvd.
Dayton 1, O.
Bearings; structural parts; friction materials —metallic, semi-metallic, non-metallic; electrical components)

POWDERED METAL PRODUCTS CORP. OF AMERICA
9335 W. Belmont Ave.
Franklin Park, Ill.
(Bearings; structural parts; cores; electrical components; magnetic materials)

PRECISION METAL PRODUCTS CO.
P. O. Box 129
Ellwood City, Pa.
(Bearings; structural parts)

PRESMET CORP.
112 Harding St.
Worcester, Mass.
(Bearings; structural parts)

PRESSCO POWDERED METAL PARTS CORP.
523 West Ave.
Norwalk, Conn.
(Bearings; structural parts)

PYRO FERRIC CO.
621 E. 216th St.
New York 67, N. Y.
(Structural parts; cores; electrical components)

RADIO CORES, INC.
9540 Tulley Ave.
Oak Lawn, Ill.
(Bearings, structural parts; cores; magnetic materials; electrical components)

SINTERED METALS, INC.
3399 Washington St.
Boston 30, Mass.
(Bearings; structural parts; electrical components; bronze filters)

SPEER CARBON CO.
P. O. Box 433
St. Marys, Pa.
(Cores, contact materials electrical components)

STACKPOLE CARBON CO.
Tannery St.
St. Marys, Pa.
(Cores, contact materials; electrical components)

THOMPSON PRODUCTS, INC.
Metro Division
23555 Euclid Ave.
Cleveland 17, O.
(Structural parts; electrical components)

U. S. GRAPHITE CO.
1621 Holland Ave.
Saginaw, Mich.
(Bearings; structural parts)

WATERBURY COMPANIES, INC.
835 S. Main St.
Waterbury 20, Conn.
(Bearings; structural parts; contact materials; electrical components)

S. K. WELLMAN CO.
1374 E. 71st St.
Cleveland 3, O.
(Clutch and brake friction materials)

WEL-MET CO.
110 Gougler Ave.
Kent, Ohio
(Bearings; structural parts; cores; magnetic materials; contact materials; friction materials; electrical components; bronze filters)

EQUIPMENT

L. ALBERT & SON
Trenton, N. J.
(Presses, mechanical and hydraulic)

AMERICAN GAS FURNACE CO.
116 Spring St.
Elizabeth, N. J.
(Furnaces, gas or oil fired; gas generators)

AMERICAN STEEL FOUNDRIES
Elmes Engineering Div.
1150 Tennessee Ave.
Cincinnati 29, O.
(Presses, hydraulic)

ANGLO AMERICAN MILL CORP., INC.
East 18th St.
Owensboro, Ky.
(Mixing and blending equipment)

R. N. BAILEY & CO., INC.
11 W. 42nd St., Suite 1942
New York 36, N. Y.
(Mixing and blending equipment; screening equipment)

BAKER PERKINS, INC.
1000 Hess St.
Saginaw, Mich.
(Mixing and blending equipment)

E. W. BLISS COMPANY
1375 Raff Rd. S. W.
Canton, Ohio
(Presses, hydraulic and mechanical)

BRILL EQUIPMENT CO.
2401 Third Ave.
New York 51, N. Y.
(Presses, mechanical; mixing and blending equipment; screening equipment)

CARDOX CORP.
307 N. Michigan Ave.
Chicago 1, Ill.
Low pressure carbon dioxide gas generators)

ARTHUR COLTON CO.
3400 E. Lafayette
Detroit 7, Mich.
(Presses, hydraulic and mechanical; mixing and blending equipment; screening equipment)

CONTINENTAL INDUSTRIAL ENGINEERS, INC.
176 W. Adams St.
Chicago 3, Ill.
(Furnaces, electric; Furnaces, gas or oil fired; gas generators)

J. H. DAY CO., INC.
1144 Harrison Ave.
Cincinnati 22, O.
(Mixing and blending equipment; screening equipment)

DORR-PATERSON ENGINEERING CO.
241 Chene St.
Detroit 7, Mich.
(Presses, hydraulic)

DREVER COMPANY
736 E. Venango St.
Philadelphia 34, Pa.
(Furnaces, electric; Furnaces, gas or oil fired; gas generators)

ECLIPSE FUEL ENGINEERING CO.
1100 Buchanan
Rockford, Ill.
(Furnaces, gas or oil fired; gas generators)

THE ELECTRIC FURNACE CO.
Wilson St.
Salem, O.
(Furnaces, electric; Furnaces, gas or oil fired; gas generators)

FEDERAL CLASSIFIER CORP.
125 N. Dearborn St.
Chicago 2, Ill.
(Air separators)

HOEGANAES

Sponge Iron Powder

Hoeganaes sponge iron powder will be available from the plant in southern New Jersey, which is now being erected.

These new greatly expanded facilities will make this fine product more available for fabricators.

For expert design consultation, call in your powder metal fabricator, who will be in a position to recommend your most profitable use of our product.

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441 LEXINGTON AVENUE
NEW YORK 17, NEW YORK
Sellers of Hoeganes sponge iron powder.

For additional information circle No. 28 on the Reader Service Card

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413 N. Third St.
Philadelphia 23, Pa.
(Mixing and blending equipment)

B. F. GUMP CO.
1325 S. Cicero Ave.
Chicago 50, Ill.
(Screening equipment—rotary)

HARPER ELECTRIC FURNACE CORP.
39 River St.
Buffalo 2, N. Y.
(Furnaces, electric)

C. I. HAYES, INC.
75 Baker St.
Providence 5, R. I.
(Furnaces, electric;
gas generators)

HEVI DUTY ELECTRIC CO.
P. O. Box 563
Milwaukee 1, Wisc.
(Furnaces, electric;
gas generators)

HOLCROFT & CO.
6545 Epworth Blvd.
Detroit 10, Mich.
(Furnaces, electric;
Furnaces, gas or oil fired;
gas generators)

INDUSTRIAL PROCESS ENGINEERS
8 Lister Ave.
Newark 5, N. J.
(Mixing and blending equipment)

C. M. KEMP MFG. CO.
405 E. Oliver St.
Baltimore 2, Md.
(Gas generators)

KUX MACHINE CO.
6725 N. Ridge Blvd.
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(Presses, mechanical and hydraulic)

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17 East 42nd St.
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LAKE ERIE ENGINEERING CORP.
520 Woodward Ave.
Buffalo 17, N. Y.
(Presses, hydraulic)

LEEDS & NORTHRUP CO
4901 Stenton Ave.
Philadelphia 44, Pa.
(Furnaces, electric)

LINDBERG ENGINEERING CO.
2450 W. Hubbard St.
Chicago 12, Ill.
(Furnaces, electric;
Furnaces, gas or oil fired;
gas generators;
heat and steam treating furnaces)

LINK BELT CO.
2045 W. Hunting Park Ave.
Philadelphia 40, Pa.
(screening equipment)

EVARTS G. LOOMIS CO.
124 S. 14th St.
Newark 7, N. J.
(Presses, hydraulic)

MERCER-ROBINSON CO., INC.
30 Church St.
New York 7, N. Y.
(Screening equipment)

MICRO CARBIDE TOOL & DIE CO.
3416 W. Washington St.
Indianapolis, Ind.
(Carbide dies for molding powder parts)

NATIONAL CARBIDE DIE CO.
Greenock Rd.
McKeesport 2, Pa.
(Carbide dies for molding powder parts)

OZARK-MAHONING CO.
310 W. 6th St.
Tulsa, Okla.
(Gas generators)

PERENY EQUIPMENT CO.
893 Chambers Rd
Columbus 12, O.
(Furnaces, electric)

READ STANDARD CORP.
York, Pa.
(Mixing and blending equipment—horizontal double arm)

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Hewitt-Robins, Inc.
270 Passaic Ave.
Passaic, N. J.
(Screening equipment)

THE SENTRY CO.
64 Main St.
Foxboro, Mass.
(Furnaces, electric)

STANDARD MACHINERY CO.
351 Indiana Ave., N.W.
Grand Rapids 4, Mich.
(Presses, hydraulic)

THE STEVENSON COMPANY
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(Mixing and blending equipment)

F. J. STOKES MACHINE CO.
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Boston 22 (Dorchester), Mass.
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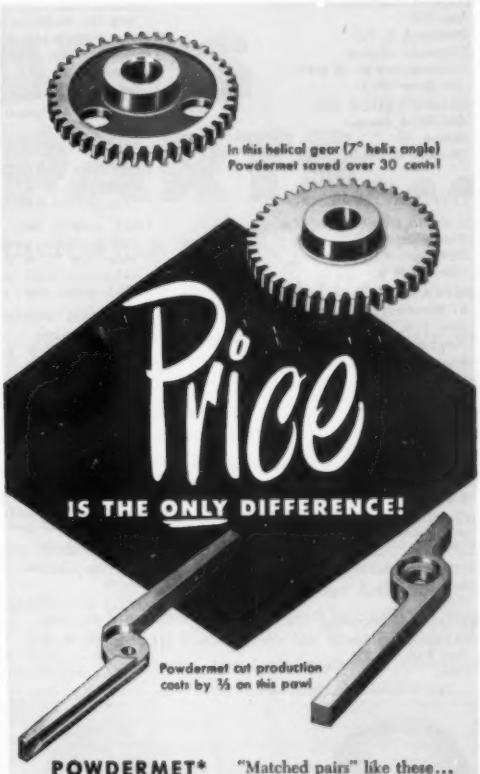
Chicago 23, Ill.
(Furnaces, electric;
Furnaces, gas or oil fired)

SURFACE COMBUSTION CORP.
Toledo 1, O.
(Furnaces, gas or oil fired;
gas generators)

W. S. TYLER CO.
3615 Superior Ave.
Cleveland 14, O.
(Screening equipment—vibratory)


In this helical gear (7° helix angle) Powdermet saved over 30 cents!
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IS THE ONLY DIFFERENCE!
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"Matched pairs" like these... actual production parts, one produced by conventional methods and one Powdermet, identical in precision and performance... prove the amazing economies made possible through Powdermet fabrication. And when special properties like electrical permeability or controlled porosity are important, Powdermet parts offer functional advantages too! Exclusive Powdermet production techniques have extended the application of powder metallurgy to whole new production fields—helical gears, stress members, filters—write today for the free booklet shown here and see how you can save with Powdermet parts!

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PMP

POWDERED METAL PRODUCTS CORPORATION of America
9233 West Belmont Avenue
Franklin Park, Illinois

*Trademark

For additional information circle No. 74 on the Reader Service Card

WESTINGHOUSE ELECTRIC CORP.
Box 868
Pittsburgh 2, Pa.
(Furnaces, electric; Furnaces, gas or oil fired; gas generators)

WILLIAMS WHITE & CO.
800 Third Avenue
Moline, Ill.
(Presses, hydraulic)

POWDER SUPPLIERS

ALUMINUM CO. OF AMERICA
Gulf Building
Pittsburgh, Pa.
(Aluminum)

AMERICAN METALS CO., LTD.
61 Broadway
New York, N. Y.
(Copper; tin; silver; brass; bronze)

ANTARA CHEMICAL DIV.
General Dyestuffs Corp.
435 W. Hudson St.
New York 14, N. Y.
(Carbonyl iron only)

BELMONT SMELTING & REFINERY WORKS
320 Belmont Ave.
Brooklyn 1, N. Y.
(Brass; copper; iron; lead; nickel; steel; tin; zinc)

PAUL BLUM CO.
315 Larkin St.
Buffalo 10, N. Y.
(Iron)

EKSTRAND & THOLAND, INC.
441 Lexington Ave.
New York, N. Y.
(Iron)

FERRUM, LTD.
506 Ste. Madeleine Blvd.
Cap de la Madeleine
Quebec, Can.
(Iron)

GLIDDEN COMPANY
Chemical & Pigment Div.
Hammond, Ind.
(Copper; lead)

GREENBACK INDUSTRIES
Greenback, Tenn.
(Copper; tin; brass)

CHAS. HARDY, INC.
420 Lexington Avenue
New York 17, N. Y.
(Aluminum; brass; copper; iron; lead; nickel; steel; tin; zinc)

HOEGANAES SPONGE IRON CORP.
545 Fifth Ave.
New York 17, N. Y.
(Iron)

MAGNETIC POWDERS, INC.
Fairview Ave.
Johnsonburg, Pa.
(Iron)

METAL HYDRIDES, INC.
16 Congress St.
Beverly, Mass
(Zirconium, titanium, chromium, metal hydrides and alloy powders)

METAL POWDERS, RGD.
Iberville, Quebec, Can.
(Iron)

METALS DISINTEGRATING CO.
P. O. Box 290
Elizabeth 8, N. J.
(Aluminum; brass; copper; iron; lead; nickel; tin; zinc; bronze)

NATIONAL LEAD CO.
111 Broadway
New York 6, N. Y.
(Lead)

PLASTIC METALS DIV.
National Radiator Corp.
Johnstown, Pa.
(Iron; nickel; steel; manganese; silicon)

NEW JERSEY ZINC CO.
160 Front St.
New York 38, N. Y.
(Brass; copper; zinc; nickel silver; bronze)

KURT ORBAN CO.
205 E. 42nd St.
New York, N. Y.
(Iron; steel; titanium; zirconium; silicon; boron)

PYRON CORP.
P. O. Box 246, LaSalle Sta.
Niagara Falls, N. Y.
(Iron)

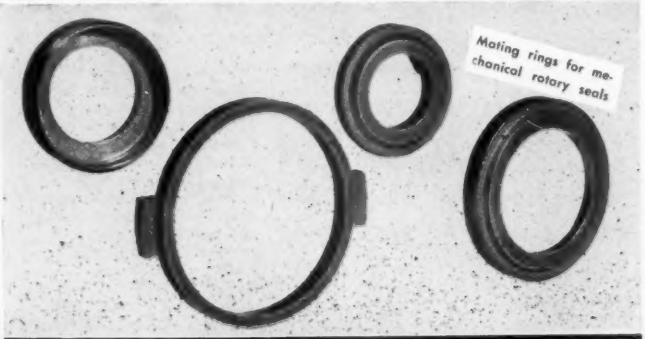
REYNOLDS METALS CO.
2500 S. Third St.
Louisville, Ky.
(Aluminum)

GEORGE R. SMITH CO., LTD.
448 S. Hill St.
Los Angeles 13, Cal.
(Iron; copper)

SYLVANIA ELECTRIC PRODUCTS, INC.
Tungsten & Chemical Div.
P. O. Box 70
Towanda, Pa.
(Tungsten powders)

VANADIUM ALLOYS STEEL CO.
Latrobe, Pa.
(Stainless steel; pre-alloyed steel)

VENTURES, LTD.
Toronto, Ontario, Can.
(Iron)



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Powdered metal parts and bearings made of exclusively formulated non-ferrous Sintroloy and Ductiloy are precision parts that simplify and speed production . . . cut costs. Now you can get non-ferrous parts that meet your exacting specifications on tolerances, surface finish, density, ductility and oil retention.

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NATIONAL MOLDED PRODUCTS, INC.
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(IRREGULAR—SPHERICAL)

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SAE 10105	SAE 5150

STAINLESS STEEL POWDERS

Type 302	Type 316
Type 309	Type 410
Type 310	Type 430

High temperature and other special compositions on request.

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CHEMISTRY
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CHARLES HARDY, INC.
420 Lexington Ave., New York 17, N. Y.
Lexington 2-4224

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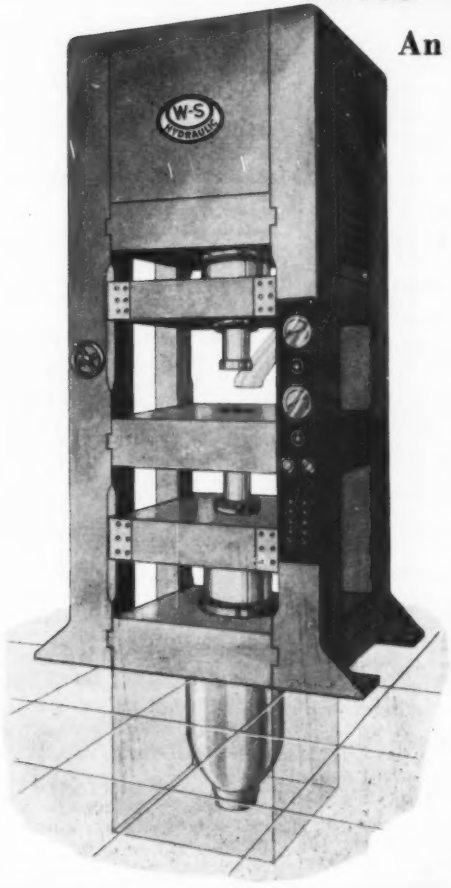
Of POWDERS *and* PARTS...



An invitation to greater profits!

Now that there is being dispelled much of the carefully guarded mystery which for years surrounded proprietary molding of complex metal powder parts, every design engineer can seriously consider powder metallurgy as an alternate source for thousands of small and medium-size components . . . with confidence of authoritative help from scores of independent sources.

Yes, blending, molding and sintering techniques and equipment have come of age. And the Watson-Stillman Company—first name in hydraulic presses—has participated in every step of this great new industry's growth. Equipped with high-speed hydraulic molding and briquetting presses from the W-S COMPLETELINE, you can now enjoy a combination of production advantages . . . in some cases, *all* of the following:

- simplify design
- drastically cut production time
- eliminate one or more operations
- reduce overall tooling
- decrease rejects
- increase man-hour productivity
- hold closer, more uniform tolerances
- employ acceptable substitutes for critical, controlled materials

The W-S COMPLETELINE includes opposed-ram molding machines from 50-50 to 300-300 tons with die-fill to 15", for parts to 10" diameter; also a line of briquetting presses to 5,000 tons.

See a W-S representative *soon*—start cashing in on this revolutionary new production technique.

HYDRAULIC MACHINERY DIVISION
Factory and Main Office: 167 Aldene Rd.
ROSELLE, NEW JERSEY

WATSON-STILLMAN (W-S HYDRAULIC)
ESTABLISHED 1848

Branch Off. 228 N. LaSalle, Chicago Ill. • Manufactured in Canada by Canadian-Vickers, Ltd., Montreal

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Akron, Ohio	Watson-Stillman Co.
Birmingham 3, Ala.	George M. Meriwether
Buffalo, N. Y.	Dan W. Patterson Co.
Dallas, Texas	M & R Sales Co.
Denver 2, Colo.	Overgard Machine Tool Co.
Indianapolis 20, Ind.	Millholland Machinery Co.
Los Angeles 11, Cal.	H. M. Royal, Inc.
Pittsburgh 19, Pa.	Stanley Berg & Co.
Portland, Ore.	Machinery & Tool Supply Co.
San Francisco 7, Cal.	Schellenbach Machinery Co.
Seattle, Wash.	Machinery & Tool Supply Co.
Spokane 8, Wash.	Machinery & Tool Supply Co.
St. Paul 4, Minn.	Anderson Machine Tool Co.

9-M-39

W-S "COMPLETELINE"—SHORTEST DISTANCE FROM PRODUCTION TO PROFIT

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The meaning of a signature!

Through a quarter of a century of knowing how, the SUPER CAST reputation for Better Methods—Better Die Castings, has been recognized.

Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

THE SUPERIOR DIE CASTING COMPANY

1001 London Road CLEVELAND 10, OHIO

For additional information circle No. 88 on the Reader Service Card

POWDER SUPPLIERS
continued from page 69

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Greenback Industries
Greenback, Tenn.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

ZINC

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.

New Jersey Zinc Co.
160 Front St.
New York 38, N. Y.

MISCELLANEOUS

American Metals Co., Ltd.
61 Broadway
New York, N. Y.
(Silver)

Belmont Smelting & Refining Works
320 Belmont Ave.
Brooklyn 1, N. Y.
(All types)

Chas. Hardy, Inc.
420 Lexington Ave.
New York 17, N. Y.
(All types)

Metal Hydrides, Inc.
16 Congress St.
Beverly, Mass.
(Zirconium, titanium chromium, metal hydrides and alloy powders)

Metals Disintegrating Co.
Box 290
Elizabeth B, N. J.
(All types)

National Lead Co.
111 Broadway
New York 6, N. Y.
(solder)

Plastic Metals Div.
National Radiator Corp.
Johnstown, Pa.
(Manganese, silicon)

New Jersey Zinc Co.
160 Front St.
New York 38, N. Y.
(Nickel silver, bronze)

Kurt Orban Co.
205 E. 42nd St.
New York, N. Y.
(Titanium; zirconium; silicon; boron)

Sylvania Electric Products Inc.
Tungsten & Chemical Division
P. O. Box 70
Towanda, Pa.
(Tungsten powders)

Vanadium Alloy Steel Co.
Latrobe, Pa.
(Stainless steel and pre-alloyed steel)

PMM INDUSTRY NEWS

FERRO BUYS 50% INTEREST IN WEL-MET

Acquisition of a 50 percent interest in the Wel-Met Co. of Kent, Ohio and Salem, Ind., has been announced by the Ferro Corporation of Cleveland, Ohio.

R. A. Weaver, chairman of Ferro, has pointed out that the move represents a further diversification of the company, although details of the acquisition have not been disclosed.

Wel-Met, engaged in the fabrication of powder metal parts, recently completed construction of a plant at Salem after its Kent plant reached capacity output.

MILWAUKEE DIE CASTING OCCUPIES NEW PLANT

One of the pioneers in the die casting industry, the Milwaukee Die Casting Co., Milwaukee, Wis., has recently moved into its new plant, located on North Holton Street in Milwaukee. The firm was located in the downtown area of Milwaukee for over forty years.

The new building, with its 44,000 square feet of floor area, represents 1/3 more than that provided in the old plant. The fact that all manufacturing operations are all on one floor will result in more advantageous placing of machines, better utilization of space, and a smooth, efficient flow of production, from the receiving of raw materials to the shipping of finished die castings.

The new plant is built on about 3 and ¾ acres, which allows ample room for future expansion. The building is of brick, glass and steel construction. It is the modern one-floor type, except for 8,000 square feet on two levels, which house the office, engineering departments, employe rest rooms and locker rooms.

A unique ventilating and cooling system in the dye casting department, where extremely high temperatures are generated, is designed to provide more comfortable and healthful working conditions.

Another feature of the die casting department is a series of connecting "underground passages", which carry the supply line for air, gas, water and electricity. This feature does away with many overhead obstructions and provides easy access for repairs or alterations in the supply system.

The Milwaukee Die Casting Company was founded in 1909 by the late Henry H. Schroeder. The present president, Henry F. Schroeder, and Frederick J. Schroeder, Jr., vice president and treasurer, are cousins, and nephews of the founder.

PRECISION CASTINGS PROMOTES FOUR EXECUTIVES

Four promotions among management personnel of Precision Castings Co., Inc., have been announced by Arthur G. Chase president and chairman of the Board of Directors.

William J. During, previously vice-president and general manager, has been promoted to executive vice-president of Precision, which has plants in Syracuse, Fayetteville, Chicago, Ill., Kalamazoo, Mich., and Cleveland, O.

Advanced to vice-presidents are J. J. Punke of Syracuse, Albert Lintel of Syracuse, and Ross W. Castle of Cleveland.

Mr. During joined Precision in 1923 as chief engineer and production manager. He was elected vice-president and director of engineering in 1936, and was elected a member of the Board of Directors in March, 1941. He was named vice-president and general manager Nov. 12, 1943.

During World War 2, Mr. During was consultant to Gen.

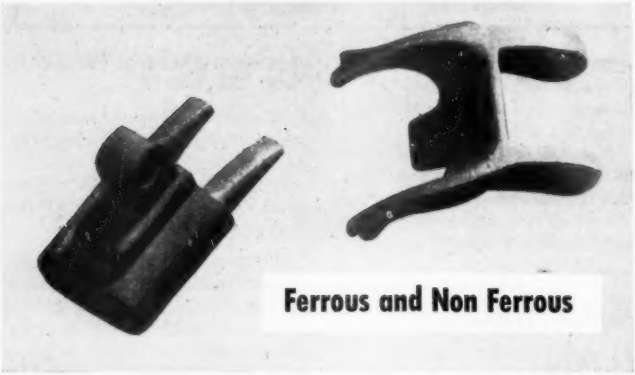
Promoted

William J. During

For additional information circle No. 19 on the Reader Service Card

Precision Castings

"LOST WAX" PROCESS



Ferrous and Non Ferrous

For those difficult small parts where dimensions are close and shapes complex, our "lost wax" castings in a variety of alloys may solve your problem. Consult with us and use our experience to your advantage.

CADMET CORPORATION

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G. M. Barnes on all non-ferrous metal applications, and at the same time was technical chairman of the die casting industry engineering committee. This committee was recently re-established as a result of previous effectiveness and Mr. During was again appointed technical chairman.

Mr. Punke, who has been chief engineer and factories manager of Precision since 1945, joined the company in 1939 as development engineer. Later he was chief engineer and in 1943 became chief engineer and factory manager. Before becoming associated with Precision, Mr. Punke was employed by Packard Motor Car Corp., Hyatt Roller Bearing Co., Oakland Motor Car Corp., General Motors Engineering Laboratory, and Hupp Motor Car Corp.

Mr. Lintel, who has been factory manager in charge of Syracuse and Fayetteville operations since 1945, joined Pre-

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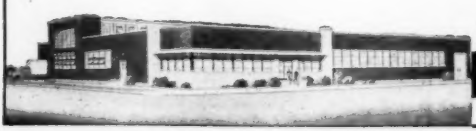

Admiral

DIE CASTING CORPORATION

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For additional information circle No. 3 on the Reader Service Card

cision in 1930 in the sales division, covering New York State and New England as eastern field engineer. Mr. Lintel's first job in the die casting industry was in 1918 with Doehler Die Casting Co. as chief inspector of the brass division and later was promoted to full charge of the

New Vice President

J. J. Punke

trimming and machining departments. In 1920 he was in charge of Doehler's Chicago plant, and in 1921 went with National Lead Co.'s die casting sales division.

Mr. Castle has been western sales manager of Precision since 1942. He joined Precision in 1921 and before promotion to his present position was sales engineer in Indiana and Southern Ohio. Prior to becoming a member of the Precision organization, he was with Wainwright Engineering Co. in Connerville, Ind., as superintendent.

FRED LUX REELECTED

Fred Lux has been reelected president of the Lux Clock Manufacturing Co. of Waterbury, Conn., and Herman F. Lux has been elected as a vice president of the company in addition to reelection as treasurer.

Other officers reelected are vice presidents, Herman J. Weisman and Carl L. Weyand; secretary and assistant treasurer, William F. Cahill; assistant secretaries, John C. Borchardt and Arnold H. Polancer.

Directors: Fred and Herman F. Lux, Joseph R. Neill, Herbert E. Schick, Arthur A. Tanner, Arthur E. B. Tanner, Mr. Weisman, Mr. Weyand and Mr. Cahill.

R. R. PRESTON DIES

Roland R. Preston, die sales engineer in the Pittsburgh office of Carboloy Department of General Electric Company, died at his home on March 5th, after a short illness.

NEW SMELTING LINE BEGINS OPERATION

The first of two new smelting lines at the Point Comfort (Texas) Works of the Aluminum Company of America recently began operation. The second is expected to be ready for operation in about three months.

The increased production represented by the two new smelting lines will bring the annual total capacity of the plant up to 135,000,000 pounds of aluminum.

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There must be a reason why so many highly discriminating manufacturers entrust *all* of their work to us. The reason is they know from experience that the finished job will meet every specification as to appearance, strength, accuracy and function. Furthermore, the price on either long or short runs is in line with their production and selling costs.

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For additional information circle No. 90 on the Reader Service Card

NON-FLAMMABLE FLUID
continued from page 47

the gaskets and packing, hose and other components.

Pydraul is inert to common metals of construction and will not break down into products which could attack metal surfaces. According to standard Army-Navy procedures for determining corrosion and oxidation stability, it has little or no effect on copper,iron,alumium or magnesium.

Specific gravity or weight. The ideal fluid weight should be as low as is consistent with other requirements in order to reduce inertia and pumping capacity requirements. As indicated Pydraul F-9 has excellent pumpability, and its weight (slightly more than water) has not introduced any cavitation or inertia problems.

Hydrolysis stability. Condensation of water in the system should not cause hydrolysis, with possible attendant increase in acid number and corrosion of the system. The neutralization number of Pydraul, indicative of acidity change hydrolysis stability, is less than 0.1 before and after hydrolysis.

Toxicity and odor. The fluid should not be toxic and should not have an objectionable odor. The Monsanto product has a mild, pleasant odor and does not give off irritating or toxic fumes at operating temperatures. It has been under test for more than a year at the University of Cincinnati. Results to date: no reason for concern. It can be handled the same as petroleum hydraulic fluid.

Service life. The ideal fluid should have good service life, as indicated by mechanical and chemical stability. The Monsanto fluid as shown by laboratory and field tests, does not break down under thermal or mechanical stress. It can be operated continuously at temperatures up to 300F.

It would appear, from this comparison, that Pydraul F-9 is very nearly the ideal non-inflammable type fluid. Its only disadvantage is that it may cause swelling in some types of gaskets and packings. Because of this it is impossible to reinstall standard packings removed from a Pydraul F-9 operated system. Unless the machine is dismantled, however, such swelling is not objectionable, and machines of all types are reported to be operating satisfactorily with packing originally installed for petroleum hydraulic fluids. In addition, materials resistant to Pydraul are available from a number of manufacturers and it is standard practice to replace packings and gaskets before reassembly after dismantling. A list of such suppliers is included at the end of this article.

All that is necessary to convert a hydraulic system is that the system be drained and clean-

continued on page 106

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Are Superior in . . .
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For additional information circle No. 68 on the Reader Service Card

FINISHING SECTION

MACHINING—Most precision metal molded parts require some machining operations. In this section will be found information to aid in planning and selecting the proper methods and equipment for these operations.

ASSEMBLING—Precision metal molded parts are generally components of assemblies. This section includes information on fastenings and methods for mass production assembly operations.

SURFACE FINISHIING—Many precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used for these surface treatments.

A Section Devoted To the Finishing Of

Die Castings
Investment Castings
Powder Metal Parts
Permanent Mold Castings
Plaster Mold Castings

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News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

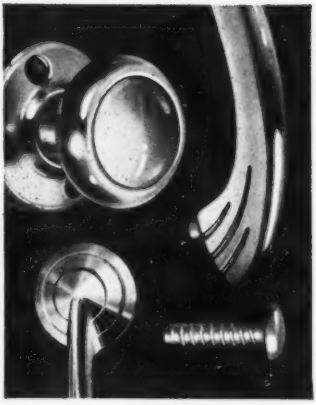
Brilliant Zinc Finish with extra life

in three easy steps

1. Plating in zinc bath

2. Treatment in Unichrome Clear Dip

3. Application of an "invisible," clear enamel



■ Combination finishes have come up as the answer for satisfactory bright finishing today – substituting for the plated finish which requires restricted nickel.

One such outstanding substitute is obtained by using only .0002" to .0005" of ordinary zinc plate and then following up by chemically treating the zinc in Unichrome Clear Dip. It is a fast, economical and easily controlled process, adaptable to manual or automatic operations. The results are startling. The plated steel or die cast product emerges from the solution bright as chromium. This Unichrome Dip Finish is integral with the zinc. It stays bright because of its good resistance to exposure, dulling, and finger-marking – thereby assuring for products not only the appeal of a bright plate but also great rust and corrosion resistance.

A COMPLETE SYSTEM

Application of a clear organic coating usually completes the finishing system. This final step is employed to assure the long service life expected of bright finishes.

Many Unichrome Clear Enamels were developed especially for use on plated or polished metals. They supply the adhesion and protective properties needed without detracting from brightness. A baked-on film of Unichrome Clear Coating B-115, for example, while virtually invisible, resists humidity, handling, discoloration and exposure. Where baking facilities are limited, Unichrome Coating A-140 is applied and then air dried or force dried to give results comparable in corrosion resistance to many coatings that are baked.

PROVED IN SERVICE

The combination of Unichrome Clear Dip and Unichrome Clear Enamel has been used with outstanding success for years on die castings, wire goods, ice skates, bicycle parts and other products and components. It proves that substitute finishes, properly fortified, can be durable and as attractive as the finishes replaced.

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More production and fewer problems in hard chromium plating

Platers have found it easier to meet stepped-up production schedules with Unichrome S.R.H.S. Chromium. It speeds up plating time by 20 to 80%. It plates smoother, with less "treeing." This means less need for depositing excess chromium to allow for grinding and final finishing. With higher cathode efficiency, S.R.H.S. Chromium uses less power to deposit the specified chromium, thereby increasing capacity of existing equipment. It also assures top throwing power, minimized control and fewer rejects through its self-regulating feature.

STEADY POWER FOR PLATING OR ANODIZING

Power supplies such as Unichrome Selenium Rectifiers offer you an "edge" today. You get units built to withstand plating room conditions, in sizes from 250 to 10,000 amperes, and you get them fast. In short, no need for long delay, or costly installation of more capacity than you can use, or frequent maintenance.

Preventive maintenance saves replacement costs

Today's shortage of metals makes replacement of equipment a serious problem. Many plating plants are, therefore, putting greater emphasis on preventive maintenance. They find that using chemical resisting Ucilon* Protective Coatings on a regular basis avoids corrosion damage to equipment and thereby minimizes not only the need for replacement but also the costly downtime. Applied to structural work, too, Ucilon Coatings keep plants looking better longer and save on yearly painting costs.

* Trade Mark

For additional information circle No. 109 on the Reader Service Card

FINISHES SUITABLE FOR POWDERED METAL PARTS

Because of their fundamentally porous nature some difficulty has been encountered in the application of standard finishing techniques to parts produced from metal powders. However, there are a number of finishes which are useful for protecting, decorating or identification of such components.

THE broader utilization of parts made from metal powders, particularly iron powder, has been retarded by the inability to secure a surface finish that was both corrosion resistant and of pleasing appearance. The inherent porosity of most structural parts made from metal powders has precluded the use of electroplating processes and until rather recently there has been no other good method of finishing these parts. Paint and lacquer can, of course, be used but the number of applications where this finish is adequate is limited.

Improved procedures for the formation of black oxide finishes, modifications of phosphate coating processes, and the development of higher density compacts have all helped toward improved surface finishes for powdered metal parts.

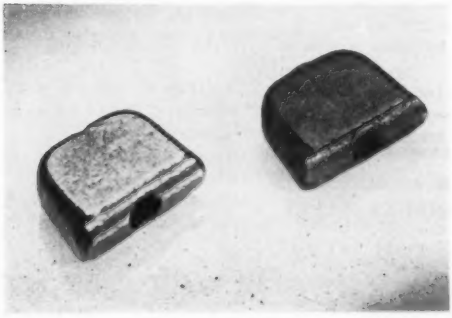
Electroplated finishes

As a starting premise it must be understood that if a part is to be electroplated, the surface onto which the finish metal is deposited must be virtually free of pits, pores and other blemishes that will impede the formation of a smooth deposit. The part must also be sufficiently non-porous so that there will be no entrapped plating liquor which can later cause discoloration, blistering or weeping. As a rough rule of thumb, one can fix an arbitrary density of 85 to 90 percent of theoretical as the lowest practical limit for electroplating.

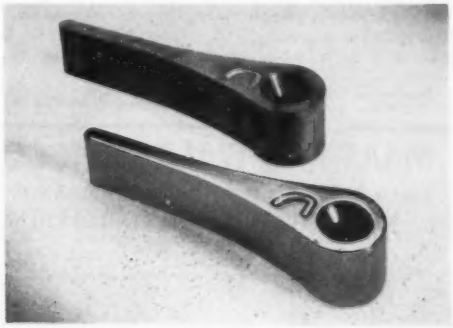
In those cases where the powder part has substantially zero porosity, the plating technique is no different than would normally be employed for parts made from wrought metal. As the porosity increases special surface sealing methods will have to be used to fill the interstices between the metal particles. In some cases a burnishinging operation is successful, either hand or machine burnishing. Experimental work and some small scale production plating indicates that hand burnishing is preferable, but the cost involved is much too high to allow this method to be used in most cases.

Here are some metal powder parts with finishes applied . . .

NICKEL PLATED BRASS. These small dot fasteners have been barrel plated with nickel, for protection and appearance.



CHROMIUM PLATED BRASS. These faucet handles have been given chromium plate to comply with requirements of the plumbing industry.



Methods of closing the surface pores that have been used are:

1. Hand burnishing
2. Re-pressing (coining)
3. Ball burnishing
4. Polishing or buffing
5. Shot peening

Next to hand burnishing, which is generally too expensive, shot peening and either polishing or buffing have been the most effective.

The cleaning of powder parts prior to plating is particularly important and is somewhat more difficult than in normal plating operations. Generally a good alkaline cleaner followed by thorough rinsing will be adequate. Failure to secure good cleaning may leave foreign matter in some of the surface pores which will prevent formation of a continuous plate and allow corrosion to start at a later time.

A study of the plating of brass parts[1] showed that thorough cleaning would allow the deposition of a continuous plate even when some surface porosity is present.

That powder parts can be successfully plated is shown by the pictures on pages 83, 85 and 86. The Dot fastener has a very thin plate of nickel on a brass part while the valve handle is chromium plated to meet plumbing requirements. Both of these parts are about 85 percent of theoretical density, both presented some difficulties until the proper plating procedure was developed, both are now in regular production.

The cylinder shown was plated purely as an experimental piece. This part had been pressed from a mixture of iron and copper (about 5 percent copper) and sintered, then coined to size. The plating was done in a commercial shop and no particular difficulty reported. At the present time, the plated surface is about eight months old and has not shown any signs of deterioration. Another iron part, not illustrated, was chromium plated by standard processes about 12 years ago and has not yet shown any signs of plating failure. This latter part had a density of 7.5 g/cc (about 95 percent of theoretical.)

If, then, certain precautions are taken parts made from metal powders can successfully be plated.

1. Be sure the part density is above 85 percent of theoretical.
2. Close surface pores as much as possible.
3. Clean thoroughly before plating.

(1) Plating of Pressed Metal Powder Parts, Graham, Pinkerton, Anderson and Reinhard. July, 1949, Plating.

Want more information on finishes for powdered metal parts?

Turn to page 34

ADHERES to almost any metal
INVISIBLE on all of them

DULAC Clear Universal Lacquer #462—a *single* water-white lacquer with remarkable adhesion to practically *all* metals. Finishing shop after finishing shop* reports that this M & W lacquer can be applied with *equal* success to just about any metal—and that it's invisible when applied. AND . . . tests conducted by an unbiased laboratory show that DULAC #462 withstands salt spray and weatherometer tests for longer periods than ordinary lacquers.

DULAC #462 forms a tough, lasting protective film that resists heat, cold, weather, stain, perspiration. It cuts *inventories*, because one lacquer handles so many metals. It cuts *production time*, because it dries out of dust in 5 to 10 minutes . . . hard in an hour. Applied by spray or dip.

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4. Wash and dry thoroughly, a neutralizing bath after plating is desirable and in some cases essential.

An alternative method that has been used with considerable success even when parts having as much as 20 percent porosity are to be plated is volatilization of the entrapped plating salts.

In most cases where plating is attempted there are few, if any, interconnecting pores. Assuming that only plating salt solutions are entrapped in the pores it is possible by heat treatment to volatilize these salts by heating the part in a controlled atmosphere furnace. Generally the chlorides can be removed easily this way and in some cases other salts. If the plating salt is one which cannot be removed easily in this manner it is possible to convert by chemical treatment to an easily removed salt. By the proper choice of chemical treatment no discoloration of the plated surface results. Should there be any minor discoloration as might be the case with a chromium plate where an oxide film will form, a light buffing will restore the plated lustre.

This process has been successfully employed by the Lionel Corporation in nickel plating of iron parts having a density of about 80 percent of theoretical.

One other factor must be remembered. The surface area of a powder part will almost always be greater than the measured surface. For this reason the thickness of the deposit will probably be less than indicated for the time in the bath.

Surface blackening

Iron parts are surface colored for corrosion resistance, improvement of appearance or for identification purposes. One common method of accomplishing this is by the so-called surface blackening processes. There are a wide variety of these processes that differ only in detail. All of them depend upon the formation of a very adherent film of oxide on the metal surface. In general the details of the process are:

1. Clean and degrease in an alkaline cleaner.
2. Descale in an acid pickling bath.
3. Immerse in blackening solution, time and temperature will vary with particular blackening salt used.
4. Rinse in cold and hot water.

The steps above are general for most of the blackening processes. One trouble that may follow when treating powdered metal parts is that the rinse after blackening is not thorough enough to remove the last traces of salts. As a result some weeping occurs after the parts have dried with the formation of salt deposits and discoloration. This carry over of salts can be avoided by treating the washed parts in a special oil which effectively replaces the salts and water entrapped in the pores of the powdered part. After this treatment the parts are left saturated with a highly inhibited oily material. The Du-Lite Chemical Co. is one of several that has developed a special oil for the final treatment of powder parts. A powder part treated by the Du-Lite process is shown.

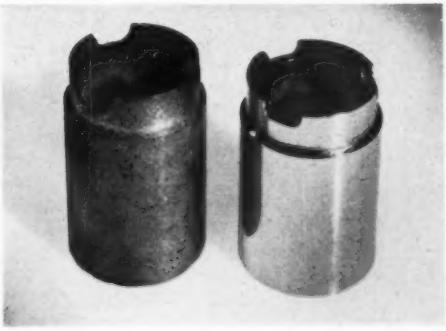
In those cases where impregnation with oil cannot be used the only alternative is very thorough washing. The only safe procedure in this case is to continue the washing until the wash water is neutral (pH 7.00) and shows no trace of any of the chemicals used in the cleaning or blacking process. Immediate and very thorough drying after washing will generally result in a satisfactory finish. Many of the chemicals used either for cleaning or blackening effloresce considerably so that the importance of complete removal by washing cannot be over-emphasized.

Steam treatments

Another surface oxidation process that has become increasingly important in the treatment of powdered iron parts is the steam treatment. In this process, the iron parts are heated to 760 F in a neutral atmosphere

Here are some metal powder parts with finishes applied . . .

CHROMIUM-PLATED IRON. The plated cylinder was processed experimentally in a commercial shop using procedures standard for other iron forms.



SURFACE-BLACKENED IRON. This part has been blackened by the Du-Lite Chemical Co. process and treated with a special oil.

and held for about 10 minutes. The temperature is then raised to 900-1000 F and steam admitted to the furnace. The parts are held at temperature in a steam atmosphere for 30 minutes and then furnace cooled. Following the steam treatment the parts are dipped in oil to impregnate them thoroughly.

This process is believed to form a coating of iron pentoxide. Below is shown a part before the steam treatment and a similar part after steam treatment and oil impregnation. This process not only gives a blue-black finish that is corrosion resistant but it improves the oil retention characteristics of porous parts. At International Business Machines Corp., for example, it has been observed that parts which have been given a steam treatment and then oil impregnated have a lower coefficient of friction, exhibit less oil bleeding, absorb a greater weight of oil and show a very high degree of corrosion resistance.

A modification of this process does not oil impregnate after the oxidation treatment. Parts so treated have good resistance to atmospheric corrosion and a brownish color.

Other surface oxidation treatments

One other surface oxidation treatment is worth noting. In this process, the iron parts are heated to about 850 F. in air and then quenched in a mixture of soluble oil and water (1 to 4 ratio). This process was developed by the Lionel Corp., to give a black finish that more nearly duplicated the standard black of railroad equipment. This finish gives a good appearing part and one that has excellent atmospheric corrosion resistance.

Phosphate treatments

Proprietary phosphate coating processes are used in treating parts made from metal powders. No special precautions need to be taken and most plants where the treatments are used follow standard practice. Due to the porous condition of most powdered metal parts, the final washing must be very thorough and in some cases a final neutralizing treatment is used.

Electrolizing

One of the newer methods of metal finishing that is being applied successfully to powdered parts is the electrolizing process. In this process a film of a hard chromium base alloy is deposited by evaporation on all surfaces of the part being treated.

Generally the evaporation is carried out in a closed chamber at very low pressures. The metal being evaporated, a chromium alloy in this case, must be heated to its boiling point at the pressure employed. The metal part being coated does not, however, need to be heated to any appreciable extent.

Initial cleaning of the part is essential and generally electrolytic cleaning is employed. In some cases electrolytic polishing is used where the finished surface is to be extremely smooth. Obviously, extreme care must be exercised to remove all cleaning and polishing materials and to thoroughly dry the part prior to electrolyzing.

The experience of the Electrolyzing Corp., of Ohio is not broad enough yet to determine what porosity limitations exist in the application of this process. It is their feeling, however, that the powder parts should be of fairly high density to be handled successfully.

The film thickness can be varied from about 30 micro inches up to 0.002 inches. As deposited, the film is about 79 to 81 Rockwell C hardness and is of a uniform thickness at all places.

Unlike electrodeposited coatings, there is no tendency to build up at corners or on sharp edges.

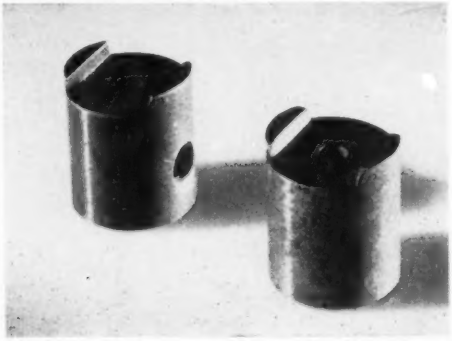
The advantages claimed for the process are:

1. An extremely hard surface that will not chip, peal, or check.
2. A uniform film thickness

Here are some metal powder parts with finishes applied . . .

STEAM PLUS OIL IMPREGNATION. Improvement in corrosion resistance and oil retention results from steam-produced oxidation.

STEAM WITHOUT OIL IMPREGNATION. It is not necessary to impregnate with oil for corrosion protection after steam treatment.



at all places (within one or two Angstrom units).
3. Corrosion resistance in a thickness of about 40 micro inches that is equal to or superior to 0.002 inches of chromium electrodeposited.
4. Greatly reduced coefficient of friction as compared with either steel or chromium plated steel.
5. Greater film density than electrodeposited coatings.
6. Increased wear life of parts and tools as much as eight times.

An example of the improvement that can be secured thru the use of electrolizing is the case of a rotor operating at 20,000 rpm. The requirements of the part would not allow any lubricant to be used, the part was rather heavily loaded. When the rotor bearings were plain steel or steel with a hard chromium plating the maximum operating life was 4 minutes. With about 0.0001 electrolized coating on the bearing the operating life was increased to 30 hours and in some cases a life of 100 hours was secured.

DON O. NOEL BECOMES GENERAL METALS V.P.

The General Metals Powder Company of Akron, Ohio, has announced the appointment of Don O. Noel as vice president, effective February 1, 1952. Before coming with General Metals, Mr. Noel was associated with the Wah-Chang Smelting and Refining Company, producers of tungsten products, in Glen Cove, N. Y. He was with Wah-Chang Company from 1949 to 1952.

Mr. Noel is a native of Montana and received his B.S. and E.M. degrees from the University of Columbia, School of Mines. Following graduation, he was associated with Metals Disintegrating Co. of Elizabeth, N. J., starting in 1929 and leaving as chief engineer in 1948.

AES MOVES OFFICES

Executive offices of the American Electroplaters' Society has been moved from Jenkintown, Pa., to 445 Broad St., Newark 2, N. J., effective April 1, 1952.

From deburring tubing . . .

to sanding bevels

Armour Backstand Belts do the job right

For the thousands of jobs where backstand belts can save you time, for the thousands of jobs other coated abrasives do so well, Armour has the answer – there's an Armour coated abrasive to do *your* job right.

Saves 3 out of 5 minutes!

The LeRoi Company in Cleveland, Ohio, switched from set-up wheels to backstand belts in finishing forged paving breaker handles. Finishing time was reduced from 5 minutes 11 seconds to 1 minute 32 seconds – *saving 3 minutes 39 seconds per handle!* Now they know, too, that Armour's coated abrasives cut faster, last longer, and give a better finish.

Belts are only one of the many forms of coated abrasives available to you from Armour. There are more than 30,000 different varieties in grit size, backing, etc. Sheets, rolls, discs, tubes – and specialty sizes to meet your specifications.

Let your industrial supply distributor tell you about this complete Armour line. And ask him for your free copy of the booklet, "Facts about Backstand Belt Grinding and Polishing" – or send the coupon today.

We recommend buying through your industrial distributor

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Please send me the free booklet, "Facts about Backstand Belt Grinding and Polishing."

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Are you SURE you're using THE MOST EFFICIENT FINISH?
If your production involves finishing zinc, cadmium, aluminum or cuprous metals, you owe it to yourself... and your customers... to investigate
IRIDITE
for on any of these metals Iridite gives you a high performance finish at a low cost from a simple chemical dip.
IF YOU WANT HIGH CORROSION RESISTANCE,
you'll find an Iridite that will meet any military or civilian specifications for chromate finishing.
IF PAINT ADHERENCE IS IMPORTANT,
you'll find Iridite prevents underfilm corrosion and soap formation.
OR, FOR BRIGHT, DECORATIVE FINISHES—
investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!
ALLIED RESEARCH PRODUCTS
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For additional information circle No. 98 on the Reader Service Card

TO SELL DEGREASERS

Announcement has been made by Topper Equipment Company, Matawan, New Jersey, successor to the former Optimus Equipment Company, that it will carry on the manufacture and sale of Circo vapor degreasers, by which tradename Topper equipment will be known.

Vapor degreasers in a wide range of sizes are available to meet a variety of industrial and automotive metal parts cleaning operations. Degreasers so designed that either trichlorethylene or perchlorethylene degreasing solvents may be used.

CARBIDE TOOLING INFORMATION AVAILABLE FROM AOA

The American Ordnance Association now has in full operation a carbide cutting tool sub-committee of its Shell Committee. Representing all manufacturers of tungsten carbide cutting tools, the committee is serving as a clearing house for carbide tooling data and on carbide problems arising in shell manufacturing.

All available technical data on application of carbides in shell manufacture has already been reviewed and a list is available to shell producers. Additional bulletins, etc., are being reviewed as rapidly as issued by individual carbide tool companies and shell producers are being advised of such additional bulletins as rapidly as they are approved by the carbide cutting tool sub-committee.

Assistance is also being provided to shell producers by the carbide committee on the organizing of training programs relating to the application of carbides in shell production.

Information as to available carbide tooling data and communications regarding carbide tooling problems in shell manufacture should be addressed to J. S. Gillespie, Chairman, Carbide Cutting Tool Sub-Committee, American Ordnance Association Shell Committee, c/o Carboloy Department of General Electric Company, Box 237, Detroit 32, Michigan.

USE Cowles LP CLEANER

for buffing and drawing compound removal

Cowles LP is an anhydrous, non-silicated soak cleaner for use on all metals except aluminum. LP removes buffing compounds, drawing compounds, and other soils without pitting or depositing white film on such work as zinc base die castings, brass, steel and other alloys. LP works rapidly and thoroughly. It leaves a chemically clean surface after rinsing.

COWLES TECHNICAL SERVICE
Gladly Furnished Upon Request

COWLES CHEMICAL COMPANY
METAL CLEANER DEPARTMENT
7016 Euclid Avenue • Cleveland 3, Ohio

NOTE *There is more information on LP Cleaner in this booklet. Send for it!*

For additional information circle No. 101 on the Reader Service Card

REFERENCE MATERIAL, catalogs and data free in this month's ads {circle numbers on reader service card.}

4. DIE CASTING FOR DEFENSE is the subject of a booklet, "We're Geared for Your Defense Needs" from Advance Tool & Die Casting.

6. ALUMINUM CASTINGS handbook describing castings, alloys & facilities — Aluminum Industries, Inc.

10. SMALL DIE CASTING MACHINES for zinc are the subject of a folder from A.B.C. Die Casting Machine Co.

11. CARBONYL IRON POWDERS are described & properties charted in a booklet from Antara Chemicals.

12. INVESTMENT CASTINGS, a survey of the process, is offered by Arwood Precision Casting.

13. DATA ON COPPER AND copper alloy powder is offered by American Metals Co.

15. PERMANENT MOLD & sand castings produced by Aluminum Permanent Mold Co. presented in a new booklet.

18. BEARINGS & STRUCTURAL PARTS produced by Bound Brook Oil-Less Bearing Co. are the subject of a booklet.

22. COMPLETE SPECS ON A die casting machine that is convertible for all die casting alloys is available from Cleveland Automatic Machine Co.

25. BLENDING EQUIPMENT for powdered metals is subject of brochure from J. H. Day.

27. VIBRATING SCREENS for separating metal powders are discussed in an Exolon catalog.

30. SINTERING FURNACES for processing powdered metal parts are shown in a catalog from Electric Furnace Co.

34. SEPARATING PULVERIZED material is the subject of a catalog from Federal Classifier Systems, presenting their equipment.

37. SMALL DIE CASTINGS — a review of size, alloy and design limits in a folder from Gries Reproducer.

38. COPPER OR LEAD POWDERS, copper brazing paste & copper oxides are described in literature from Glidden Co.

39. SINTERING FURNACES are included in detailed literature from Harper Electric Furnace Co.

42. DIE CASTINGS BY HOOVER are presented in a booklet from The Hoover Co. describing company facilities.

43. DIE LUBRICANTS for die casting are explained, and some recommendations offered in literature from E. F. Houghton.

44. HIGH-SPEED DIE CASTING machines are presented by Hydraulic Press Mfg. Co.

45. DESIGNING FOR POWDER metallurgy is the subject of an engineer's handbook from International Powder Metallurgy.

46. PROPERTIES OF A NEW alloy of aluminum are listed in a brochure on Almag 35 from Wm. Jobbins.

47. SMALL-BATCH MELTING for investment casting with special furnaces. Kuhlman Electric Co.

48. PRESSES FOR POWDER metallurgy are subject of a complete catalog from Kux Machine.

49. COMPLETE STORY OF POWDER metallurgy is offered by Kwikset Lock Co.

50. DETECTING FLAWS in castings with a new Color-Test method is described in literature from K & W Products.

51. INDUCTION MELTING FURNACES with 2 chambers for nonferrous alloys are described in bulletin from Lindberg-Fisher.

52. HOW TO DESIGN aluminum & magnesium die castings is the subject of a data book from Litemetal Dicast.

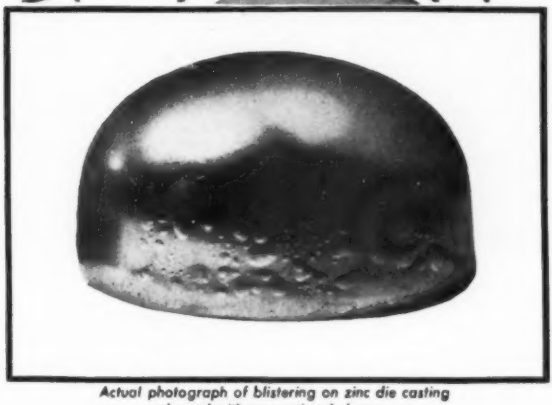
55. HYDRAULIC OIL FILTERS produced by Marvel Engineering are presented in a data sheet.

57. SPECIFICATIONS FOR Cast-Master die casting machine are presented in a catalog from Miller-Taylor.

60. NON-FLAMMABLE HYDRAULIC fluid is subject of a data book from Monsanto Chemical.

continued on page 92

STOP BLISTERING, STREAKING ON ZINC BASE DIE CASTINGS!



Actual photograph of blistering on zinc die casting cleaned with conventional cleaner.

Designed especially for reverse current electro-cleaning of zinc base die castings prior to electroplating, new Diversey No. 505 completely, safely removes all unwanted deposits! In addition, Diversey No. 505 conditions the surface of the zinc, providing better adhesion between the electro plate and the base metal!

This unique, double-action of Diversey No. 505 helps provide a uniformly clear, brilliantly lustrous finished surface . . . one free from blistering, peeling and streaking! Diversey No. 505 is economical, easy to use and available now! Investigate Diversey No. 505 today! *Mail the coupon for FREE copy of New Bulletin.*

DIVERSEY No. 505

NEW electro-cleaner and surface conditioner!

MAIL THIS COUPON TODAY

THE DIVERSEY CORPORATION
Metal Industry Department
1820 Roscoe Street • Chicago 13, Illinois
In Canada: The Diversey Corporation (Canada) Ltd.
Lakeshore Road, Port Credit, Ontario

THE DIVERSEY CORPORATION
Metal Industry Department
1820 Roscoe Street, Chicago 13, Illinois

Gentlemen:
Please send me complete information, including New Bulletin on Diversey No. 505.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City*_____ *State*_____

For additional information circle No. 102 on the Reader Service Card

If you use air

This compact, 4-way electrically-controlled VALVE will simplify YOUR DESIGN PROBLEMS

The Bellows air-powered, electrically-controlled air valve is so fast it will complete 2000 or more movements a minute. Yet its unique low voltage solenoids will operate all day without discernible hum, pounding, or overheating. So sturdily built, in fact, that we guarantee its solenoid control units against burnout.

The Bellows Electroaire Valve* is so compact it can be held in the palm of a hand, yet it combines in one complete unit a four-way directional valve, piston speed regulators, and low voltage electrical controls. It will operate safely and efficiently even if submerged, covered with coolant, or piled high with dirt or chips. It is self-adjusting to widely varying air pressures . . . operates on 5 to 150 lbs. of air.

Made in ¼", ⅜" and ½" port sizes, the Bellows Electroaire valve can be adapted for direct connection to, or remote control of any standard air cylinder. It is a built-in feature of all Bellows "Controlled - Air - Power" Devices arranged for electrical control.

Write for These Free Bulletins

Case histories, wiring diagrams, technical data on the Electroaire Valve and other Bellows pneumatic equipment. Ask for Bulletin AV-300 and CL-30. Address: The Bellows Co., Dept. DC452, Akron 9, Ohio.

*TM Registered — Patent Pending

1201

The Bellows Co.

AKRON 9, OHIO

FASTER, SAFER, BETTER PRODUCTION — WITH "CONTROLLED-AIR-POWER"

For additional information circle No. 99 on the Reader Service Card

63. POROUS BEARINGS with oil reservoir are subject of literature from Michigan Powdered Metal Products.

64. TITANIUM & ZIRCONIUM POWDERS, technical information on improved processing techniques, in literature from Metal Hydrides.

65. DIE CASTING FACILITIES of the New England Die Casting Co. are described & illustrated.

66. DIMENSIONING DIE CASTINGS is the subject of a guide-book from Newton New Haven Co.

74. ADVANTAGE OF POWDER metallurgy and the company's facilities for producing powdered metal parts are subject of a booklet from Powdered Metal Products.

75. ELECTRONIC CORES produced from powder are the subject of a catalog and booklet from Radio Cores, Inc.

77. PROTECTION FOR HYDRAULIC fluids from overheating by use of heat exchangers. Ross Heater.

78. AUTOMATIC SHOT CONTROL for die casting zinc or aluminum is subject of a technical bulletin from Ring Valve Co.

88. PLASTER MOLD CASTINGS are discussed in catalog from Universal Castings telling about the process, alloys, physicals & typical parts.

90. MACHINES FOR MOLDING polystyrene patterns for investment casting are presented in a catalog from Van Dorn Iron Works.

96. IRIDITE FOR PROTECTING metal surfaces is described in literature from Allied Research.

continued on page 113

FIELD REPORTS PROVE IT!

NEW "61" SERRATED RUBBER CONTACT WHEEL

can double the productive life of your abrasive belts

REPORT NO. 1254

ACCOUNT:	Midwest appliance manufacturer.
EQUIPMENT:	"61" contact wheel, 14" x 4". Belt: 120 grit, industrial cloth, 148" x 4".
OPERATION:	Light snagging of die cast aluminum washing machine motor housings.
RESULTS:	Operation formerly done with conventional wheel at rate of 80 pieces per belt. Present operation with "61" wheel attains 160-170 pieces per belt.

Those special serrations you see in the face of the "61" contact wheel cause a controlled breakdown in the bond of the abrasive belt. Glazing is practically eliminated —belt life is amazingly lengthened. Output per belt and per day is way up—finishing costs are cut to rock bottom. Get the whole "61" story now, from your CARBORUNDUM or distributor salesman—or write Dept. PM 82-64.

Only CARBORUNDUM

TRADE MARK

offers ALL abrasive products ...to give you the proper ONE

"Carborundum" is a registered trademark of The Carborundum Company, Niagara Falls, New York

For additional information circle No. 100 on the Reader Service Card

PMM NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail —no postage is required.

"ROLL-OVER" FURNACE FOR INVESTMENT CASTING

Ajax-Northrup Induction Furnace
Ajax Electrothermic Corp.

SPECIAL FEATURES: High-speed melting; lever-controlled rotation of the furnace fills the mold at the most desirable pouring rate; temperature and analysis can be closely controlled.

SPECIFICATIONS: At the end of the melting period—12 minutes for 5 lbs. of alloy steel—the preheated mold or investment is clamped directly to the top of the crucible with a specially-fitted mold-holder. Operation of a control lever causes the furnace to rotate to pouring position. Powered by a standard Ajax-Northrup 20 kw. mercury hydrogen type converter and operates at a frequency of about 30,000 cycles. The converter can also be used to power other melting furnaces or for various types of heating equipment.

Induction furnaces are adapted for melting complex alloys common to high temperature, corrosion-resistant applications. Since there are no carbon electrodes, there is no chance for carbon contamination.

For further information circle No. 198 on the Reader Service Card

LARGEST CONICAL DRY BLENDER

Patterson Foundry & Machine Co.

SPECIAL FEATURES: Reported to be largest conical dry blender ever built. Designed especially for efficient, fast-acting mixing of dry, free-flowing materials such as powdered metals, dry chemicals, roofing granules, etc.

SPECIFICATIONS: Unit is 13 ft. diam., has a total capacity of 1,000 cu. ft., and a working capacity of more than 700 cu. ft. Holds a batch of approximately 30,000 lbs. Unit was built for a customer whose process could not be handled in segments, and is similar to other Patterson blenders used for powder metallurgy, chemical mixing, plastic molding compounds, etc.

For further information circle No. 203 on the Reader Service Card

SERIES OF AIR CYLINDERS

Rivett Air Cylinders
Rivett Lathe & Grinder, Inc.

SPECIAL FEATURES: By using keeper rings to hold covers together instead of the conventional tie rods, the covers can be rotated to convenient pipe locations and the cylinder applied in a minimum of space.

SPECIFICATIONS: The new line of air cylinders comprising 28 different models, each in 9 bore diameters, are recommended for pressures up to 150 psi. Available in 7 mounting styles, in any length of stroke up to 96", single or double-end rods, with internal or external thread, and cushioned rod end, blind end, or both. Self-adjusting composition cup packing; self-adjusting composition rod packing; axial holes through rod bearing provide for pressure disposal on packing members.

For further information circle No. 197 on the Reader Service Card

REAMING & TAPPING SMALL HOLES SIMULTANEOUSLY

Automatic Drilling & Tapping Units
Govro-Nelson Co.

SPECIAL FEATURES: Performs the difficult job of reaming and tapping exceedingly small holes simultaneously.

SPECIFICATIONS: Small brass discs are first run through a Govro-Nelson drilling machine where two holes are drilled and a third hole drilled and counterbored with a combination tool for the tap.

The part is then run through the machine illustrated above which incorporates two Govro-Nelson Automatic Drilling Units to ream the previously drilled .0709 holes, and one Govro-Nelson Tapping Unit to tap the #00-96 hole, all done simultaneously. Output of the machine is 10 pieces per minute.

By varying the position of the units and the tools employed, the machine can be adapted to other reaming and tapping operations.

For further information circle No. 204 on the Reader Service Card

ABRASIVE-BELT GRINDER FOR LARGE AREAS

Grinder Model No. 506
The Porter-Cable Machine Co.

SPECIAL FEATURES: Handles jobs which had previously been run on wider, more expensive belts; designed for all-purpose grinding operations; can be changed from vertical to horizontal operation in one minute by loosening two hex nuts.

SPECIFICATIONS: Equipped with standard 6" belt which runs over 12½" platen. Used primarily for free-hand applications on work requiring flat surfaces, deburring, squaring, chamfering, rounding or polishing.

Suitable for metal, wood, glass or plastics. Equipped with 2-speed pulleys for 3300 and 4000 sfpm; Pretensioning device eliminates need for releasing idler tension pressure each time the belt is changed. Built-in coolant system.

For further information circle No. 198 on the Reader Service Card

COBALT NON-DESTRUCTIVE INSPECTION

Tracerlab, Inc.

SPECIAL FEATURES: Low cost, non-destructive method of inspecting metal objects for flaws, particularly useful for the occasional user.

SPECIFICATIONS: Nineteen Cobalt-60 Radiography Sources, ranging in strength from 50 millicuries to 25 curies. Sources are 21 mm long by 10 mm wide, allowing them to be replaced inside of complex castings.

Gamma rays emitted by Cobalt-60 have energies of 1.17 and 1.33 million electron volts which correspond closely to the effective energy of a 2 million volt X-ray machine. These energies will permit inspection of steel from ½" to 6" without excessive exposure times.

For further information circle No. 199 on the Reader Service Card

CLEANING MACHINE FOR SMALL PARTS

Instro-Met

Zenith Mfg. & Chemical Corp.

SPECIAL FEATURES: Especially designed for cleaning delicate parts and small pieces. Principal fields for which intended are aviation, clock, meter, radio, TV and all small electrical or mechanical components.

SPECIFICATIONS: Spun aluminum tanks & covers, 10" high x 10" diam., 4 gal. capacity. Three clear-view windows for constant checking during operation. Heavy cast aluminum basket with increased capacity. Basket has 3 monel mesh removable departments for cleaning different parts simultaneously.

For further information circle No. 200 on the Reader Service Card

WAX LUBRICANT FOR METAL CUTTING

#140 Stik-Wax

S. C. Johnson & Son, Inc.

SPECIAL FEATURES: Increased life of drills, saws, etc., is reported, as well as better finish and elimination of burrs. Smoother metal surfaces are said to result when it is used on grinding or sanding operations.

SPECIFICATIONS: Blend of solid waxes in stick form for durable, clean lubrication for metal sanding, drilling, tapping, grinding, flush riveting, cutting, etc.

Stik-Wax can be applied manually by the operator or set in position so that it is automatically applied.

For further information circle No. 201 on the Reader Service Card

LINING FOR NON-FERROUS FURNACES

Plasti-Bond

National Foundry Sand Co.

SPECIAL FEATURES: Specifically intended as coating or lining for non-ferrous melting furnaces and crucibles.

SPECIFICATIONS: One of a line of "Hy-Temp Refracto" foundry products including bricks, special shapes, bonding cement and lining materials.

For further information circle No. 202 on the Reader Service Card

what is?

Color Test

Color-Test is a method of inspecting parts to

LOCATE CRACKS, FLAWS OR POROSITY IN ANY METAL ANYWHERE, ANYTIME IN THE PLANT...IN THE FIELD!

K&W

Color-Test is economical and easy to use.

K & W PRODUCTS, INC.
P.O. BOX 231 WHITTIER, CALIF.

SEND TODAY FOR COMPLETE INFORMATION FREE!

For further information circle No. 50 on the Reader Service Card

Are YOU getting BURNISHING results like these?

A MANUFACTURER OF AIRCRAFT INSTRUMENT PARTS uses Oakite Composition No. 3 in all tumbling and burnishing barrels. Results are splendid on castings, stampings and machined parts . . . "Steel gear plates look like mirrors. Pinions are polished to the roots of the gears. Magnesium parts are brilliant" . . . "Oakite Composition No. 3 is here to stay."

For burnishing steel, stainless steel, brass, aluminum, magnesium, lead alloys, zinc alloys and other metals . . . Oakite Composition No. 3 gives RICH SUDS in hard or soft water; LUBRICATES SMOOTHLY to prevent metal-on-metal scratching; RINSES FREELY leaving no soapy film on work, balls or stones; IMPROVES LUSTER quickly at low cost per unit.

For FREE BULLETIN giving interesting facts about OAKITE COMPOSITION NO. 3, write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

For further information circle No. 105 on the Reader Service Card

PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail — no postage is required.

PROCESSES

Centrifugal and Vacuum Investment Castings: No. 144
Some specific features and advantages of the Electronicast method of investment casting are the subject of a folder available from Electronicast, Inc., of Chicago. In addition to pointing out some unique characteristics of the process, the folder touches on sizes of parts, metals that can be cast, physical characteristics and tolerances.

Series of Bearing Data Sheets: No. 145
From Johnson Bronze, New Castle, Pa., can be obtained a complete set of data sheets on bearings, including information on powder metallurgy for bearings and parts.

How to Obtain Long-Wearing Machinery Parts: No. 146
In a new 24-page booklet with more than 60 blueprint drawings, tables and photographs, Haynes Stellite Co. presents a wide variety of cast and wrought alloy parts now being used in many industries to solve abrasion, corrosion and high temperature problems. Title of the booklet is "Long-Wearing Machinery Parts."

Die Cast Cap Nuts: No. 147
The advantages of a line of standard die cast zinc cap nuts with class 2 threads tapped square with the face of the nut are pointed out in a bulletin from Gries Reproducer Corp.

Eighty Alloys That Can Be Investment Cast: No. 148
In one of the most complete tabulations yet offered, Precision Metalsmiths, Inc., have prepared a series of oversize data sheets that give comprehensive information about 80 ferrous and nonferrous alloys that they are now able to investment-cast. Alloys are identified, and information concerning nominal composition, heat treatment, physical properties, mechanical properties and general characteristics are included. Among the groups of metals are alloy steels, tool steels, stainless steels, cast iron, and aluminum, cobalt, copper, nickel, hard-facing and miscellaneous alloys.

Advantages of Powder Metallurgy: No. 149
Besides showing the basic steps concerned in the production of a powdered metal part, an 8-page folder issued by Kwikset Locks, Inc., Powdered Metal Div., tells the advantages of powder metallurgy for producing industrial parts. Title of the brochure is "Powdered Metal Parts for Industry."

MATERIALS AND EQUIPMENT

Complete Catalog of Combustion Equipment No. 154
In a conveniently arranged catalog, Eclipse Fuel Engineering Co. of Rockford, Ill., presents a complete line of combustion equipment. Included are specifications and illustrations of burners, mixers, valves and blowers.

Special Heat-Resisting Melting Kettles for Die Casting: No. 155
A one-page data sheet from C. H. Milles Foundry Co. gives measurements specifications and drawings of a line of melting kettles made of a special heat-resisting alloy iron for the melting of zinc and aluminum die casting alloys, as well as lead, babbitt and other non-ferrous metals.

Specification Sheets for Die Casting Machines: No. 156
New specification sheets for current models of Lester-Phoenix die casting machines have been prepared by Lester-Phoenix, Inc. Besides bringing all specs up-to-date, the principal innovation is that die space details are clearly shown in drawings printed on the sheets as an aid in designing dies.

Shot Control Valve Reduces Porosity of Die Castings: No. 157
An automatic shot control valve which can be installed on zinc or aluminum die casting machines to reduce porosity and eliminate surface flaws is the subject of a data book from Ring Valve Co., Clawson, Mich. This device, which injects the metal in an automatic two-stage cycle, is described, illustrated and explained. Full operating instructions are included.

Selection of Sintering Equipment: No. 158
Both batch and continuous type sintering furnaces are amply illustrated and described in new bulletin No. 230 from Lindberg Engineering Co. The company also gives full data on its atmosphere generators in Bulletin No. 190.

Vane-Type Oil Hydraulic Pump: No. 159
A 2000 psi vane-type oil hydraulic pump that can also be used as a fluid motor is announced in literature from The Denison Engineering Co., Columbus, Ohio.

Equipment for Screening Powders: No. 107
A line of equipment and wire cloth for sifting, separating and grading metal powders and other finely divided materials is included in a catalog from Robinson Mfg. Co. describing their Gyro-Sifters.

Air Power at Work: No. 160
Many new ideas for utilizing air power for work feeding, machining, assembling, timing, swaging, etc. are contained in a well-illustrated booklet from Mead Specialties Co. of Chicago entitled, "Air Power at Work." The booklet contains 39 case histories showing production problems and how they have been solved.

FINISHING

Case Studies of Abrasive-Belt Machining No. 166
Employing a pictorial technique throughout, The Porter-Cable Machine Co. of Syracuse has put together a 32-page book of case histories on abrasive-belt machining. A total of 46 examples are included, with photos showing the abrasive-belt operation as well as a closeup of each. One section is devoted to background data on this method and its advantages.

Simplified Method of Wet-Blasting: No. 167
A simplified method of wet-blasting for close tolerance finishing is described in a folder from American Wheelabrator & Equipment Corp. on the subject of the new Liquamatt wet blasting unit.

Concentrated Paste for Use in Barrel Finishing: No. 168
A new chemical in highly concentrated paste form for use in barrel finishing of non-ferrous parts is the subject of Bulletin No. 1 from Blue Magic Chemical Specialties Co. of Philadelphia, Pa.

How to Dimension Machine Screws: No. 169
A chart showing how to dimension 11 standard types of machine screws is available for mounting in drafting, production and purchasing departments. It has been made available by the Progressive Manufacturing Co. of Torrington, Conn.

Grinding Titanium: No. 170
Grinding wheels and grinding techniques for titanium are discussed in the feature article of the current issue of Grits and Grinds published by the Norton Co.

Guide to Better Plating Power: No. 171

An illustrated catalog, "A guide to Better Plating Power," is available from Bart-Messing Corp. of Belleville, N. J., manufacturers of a complete line of selenium rectifiers.

How to Solder Aluminum: No. 172

Admitting that soldering "has not yet reached the stage where it can be done as easily as soldering steel, brass, copper or tin," a detailed article in issue No. 17 of the Reynolds Metals Technical Advisor gives a full report on "Soldering Aluminum — 1952." Besides giving extensive technical details, the article includes a table of fluxes and solders for aluminum.

Die-Sinking Cutters and End Mills: No. 173

A new line of die-sinking cutters and end mills is introduced in a catalog from The Metal Removal Co. of Chicago. These cutters are available from factory stocks in a range of standard sizes, single and double end type or large diameters, 2, 3 or 4 flutes, straight or spiral flute, straight or ball ends.

Two Aluminum Solders: No. 174

Two aluminum solders especially for joining copper to aluminum or other metals, and 10 rods and electrodes for work on copper or copper-bearing alloys with torch, soldering iron or arc, are featured in a folder released by All-State Welding Alloys Co., Inc., of White Plains, N. Y.

Chemical-Resistant Tanks, Pipe & Lining for Plating: No. 175

In a series of data sheets, The Chemical Corporation of Springfield, Mass., offers information on a full line of chemical-resistant tanks, pipe, linings, plating barrels, vent hoods, duct material, coatings and dye-house trucks. The Pla-Tank products are formed of Fibre-glass mat impregnated and bonded with polyester resins to form strong,one-piece units.

Depositing Hard Surfacing Alloys by Vaporization: No. 176

Solution of wear, abrasion and corrosion problems by the deposition of .0002 (max.) of a hard alloy on edges or surfaces of tools and machine parts is the subject of a booklet describing the advantages and characteristics of the Electrolizing process. The booklet is available from The Electrolizing Corp. of Ohio.

Protective Coating for Aluminum Applied by Brushing: No. 177

A description of "Brush Alodine" is contained in a leaflet from American Chemical Paint Co. This material is a protective coating for aluminum which can be applied with a brush or other simple equipment. Process results in paint bonding and corrosion resistant coating.

ROTO FINISH

CUTS DEBURRING COSTS
50% to 90% on individual parts
at the WHIRLPOOL CORPORATION, St. Joseph, Michigan

...saves...

helps 6 people do the work of 16

The Whirlpool Corporation found a real solution to manpower scarcities and rising prices when they installed Roto-Finish Deburring Machines. By this mechanical method, 6 people now deburr an even greater quantity of parts than 16 could do before. Thus a much needed source of manpower was found for use in other operations.

The cost of deburring individual parts has been reduced 50% to 90% as shown above. And in addition, parts can now be deburred economically that were impossible to do by hand methods because the cost was prohibitive. Roto-Finishing these parts in some cases has eliminated special handling in subsequent operations. As a result, production has been speeded and manhours have been saved in stamping, grinding and other finishing operations.

Let us show you how you can make similar savings in time, manhours and money. Send sample parts to the Roto-Finish laboratory for a free demonstration. Write for full details today.

Roto-Finish COMPANY

associated with The Sturgis Products Co.
3716 MILHAM ROAD, KALAMAZOO, MICH.

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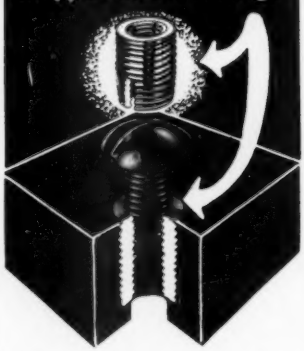
ORIGINATORS OF THE ROTO-FINISH PROCESSES
For additional information circle No. 106 on the Reader Service Card

TAP-LOK INSERTS

for original installations and stripped thread salvage



Tapped threads that strip easily are a headache to customers. Thread failure in light metals, plastics and similar materials can be prevented by the Tap-Lok Insert, a hard steel bushing that increases the shear area.

These Inserts are widely used for original installation because, being self-tapping, they save many man-hours in assembly. They are quickly installed with a simple driving tool into a cored or drilled hole equal in size to a tap drill hole for the external thread of the Insert. They hold rigidly in position and do not become loosened when the male part of the fastening is removed.

The Inserts are also extensively used for the salvage of threads stripped in assembly. Many manufacturers are using them for this purpose to reduce the high cost of rejects.

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ELECTROPLATERS' SOCIETY SHOW AND MEETING

The Industrial Finishing Exposition of 1952 sponsored by the American Electroplaters' Society at the International Amphitheatre, Chicago, will be held concurrently with the AES 39th annual convention June 16-20 in the Conrad Hilton Hotel (formerly the Stevens).

Manufacturers of plating equipment and supplies, paint and allied equipment, abrasives, masking tapes, chemicals, polishers and buffers, safety devices, materials handling apparatus, etc. will exhibit. Headquarters are at 35 E. Wacker Drive, Chicago 1, Illinois.

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COWLES CHEMICAL CO. HONORS E. S. BASSETT

Edward S. Bassett, secretary of Cowles Chemical Company, was recently honored at a luncheon held at the Wade Park Manor Hotel in Cleveland, attended by all Cleveland employees of the company. He was presented a gold pin for 30 years of service by Robert F. Huntley, vice president and general manager.

Mr. Bassett has been a director of Cowles continuously since November, 1918. In 1926 he was appointed general manager, and was elected president in 1930 in which capacity he served until 1938. He was chairman of the Board until 1941, when that office was abolished and he became secretary. In late years Mr. Bassett has been on a partially retired basis.

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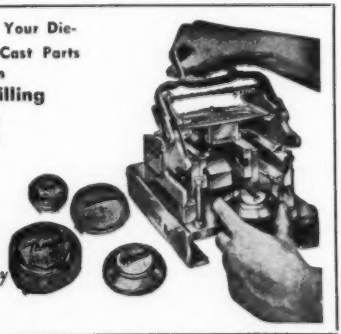

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HIGH DENSITY
continued from page 34

bered that in powder compacts we are dealing with essentially manganese free material. Therefore, the critical cooling rate of the steel will be excessively high and uniform hardening of other than thin sections (not over ½ inch) will be virtually impossible. This, then, brings up the subject of carburization of these iron compacts.

Because they are sound, homogeneous steel, high density powder compacts can be case carburized by any of the normal processes. Any case depth desired can be secured though more than 0.050 is seldom recommended. Following carburization the compact is hardened and drawn, if desired, in the usual manner. Case hardnesses up to 65 Rockwell C are easily achieved. Parts that have been case hardened and then drawn shown all of the same characteristics exhibited by wrought steel of the same initial carbon content and heat treated in the same manner.

Thin sections that have been uniformly carburized throughout and then hardened have shown tensile strengths as high as 150,000 psi with an elongation of about 1 percent in two inches.

There are, of course, many cases where a higher carbon content is wanted than can be secured by the sintering of a dense compact in endo gas and then case carburizing. For such parts there are available fully annealed plain carbon steel powders and alloy steel powders of uniform carbon and alloy content. The individual powder particles of these materials are the same composition as the parent metal from which they are made whether it be an SAE 1040 or an SAE 4640 steel. These powders will give compacts having the same physical properties as wrought material of the same composition if pressed and sintered to full density. If any lower density is secured, the physical properties will of course be somewhat reduced. The processing of these powders generally follows the lines to be described for low carbon steel parts, although some special processing is necessary. The suppliers of these powders, Charles Hardy, Inc., of New York, and the Vanadium Alloys Steel Co., of Latrobe, Pa. have worked out adequate processing methods for them. One factor must be born in mind when working with the high carbon steel materials. *The sintering atmosphere must be such that it will not decarburize the powder.* This means either an endogas atmosphere of proper carbon balance or a completely neutral (with respect to car-

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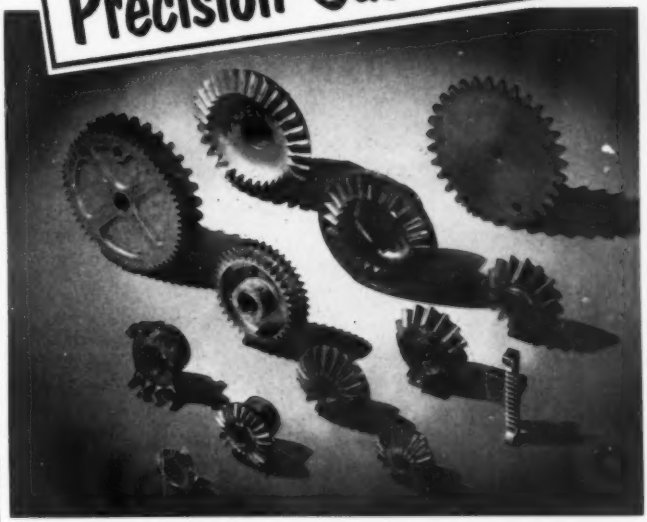

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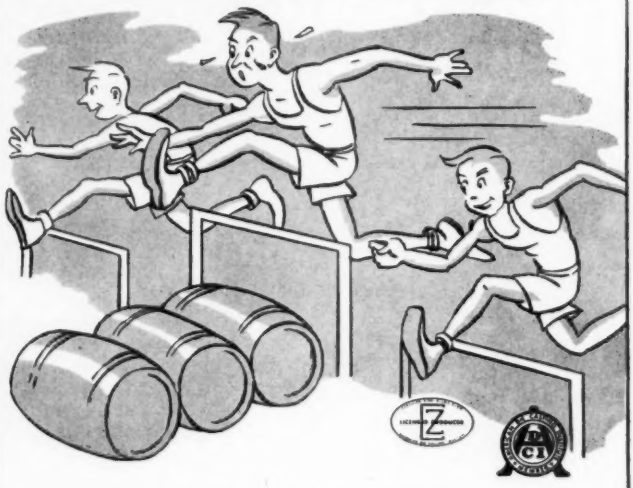
bon) atmosphere such as dry hydrogen or dissociated ammonia.

While these powders are not widely used at present, they do give to the designer a wider field of materials from which high strength powder compacts can be made.

Assuming that powdered iron compacts having the same or superior physical properties to comparable wrought steels are made, the designer is naturally interested in the machinability, joining and surface finishing of them. Machinability and joining follow standard shop practice in practically every respect. On surface finishing some concession must be made. If the part is truly high density, say 95 percent of theoretical or higher, standard practice for all surface finishing operations may be carried out. In the range of from 85 to 95 percent of theoretical density all of the standard finishing operations may be used successfully except electroplating. In this latter case, there is some tendency for plating solutions to be trapped in the minute surface pores for the metal which may result in subsequent blistering. This can be eliminated by surface burnishing or buffing. In some cases a filler may be used to good advantage.

PUTTING YOUR BUSINESS OVER UNNECESSARY HURDLES...?



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PROTOTYPE DIE CASTINGS continued from page 51

It is interesting to note that this shape which is fairly complex, has a central shaft hole with two flats. It was cast ready for use without machining. The other two lock parts in Figure 2 were cast in a specified zinc alloy and subjected to a series of performance and life tests.

All of the castings illustrated here were of such a shape that low fusing point metal molds were preferable to rubber molds, and the patterns were wax. Finished castings were delivered two weeks after receipt of the master models.

Some of the other prototypes produced by Kerr include a slot casting for a coin machine, a license plate holder for a show model of an automobile, and some motor parts for electric shavers, subsequently die cast.

The electric shaver parts were investment cast in brass and aluminum and when they reached full-scale production, were die cast in aluminum.

Because the casting of prototypes presents problems seldom encountered in the average investment casting, Kerr prefers to work closely with the customer because it is more economical for the customer if this work is done on a time and material basis. Here again, investment castings, like other kinds of castings, become of greater interest to the contract fabricator as quantities increase. However, where it

can be obtained by the die caster or a buyer of die castings, the investment cast prototype offers some advantages worth considering.

BUILT-IN RESERVOIR
continued from page 35

bronze is applied by powder metallurgical techniques after the oil well bushing has been made. This bronze liner can be made in almost any thickness, but is customarily supplied about 0.010 thick.

Bearing "c", Figure 1, shows another design of an oil well bearing. Here both the bushing shape and the design of the oil well have been changed. Almost any shape of oil well can be made, depending upon the service requirements of the bearing.

Another dramatic application of the oil well bushings is for pure sliding friction applications such as the guides of die sets. The die set shown in Figure 2 was originally equipped with oil well bushings. After over 20,000,000 strokes, there was no appreciable wear on either the guide pins or the guide pin bushings. For this type of service, the bushings are case carburized and hardened prior to impregnation with oil. On another die set, one oil well bushing and one standard steel bushing were installed. The oil well bushing was still in good condition after two standard steel bushings had been worn out.

Oil well bearing material can be made in almost any shape. Figure 3 shows a different shape and type of oil well bearing material. Here instead of an open well, a core of very porous metal is used. This porous metal acts as a wick-type reservoir for the lubricant. One most promising application for this type of material is for the gibs on machine tools. The relatively high density surface can be molded to shape and then carburized, hardened and ground. After impregnating with oil or grease, the gibs can be depended on to lubricate the machine ways, probably for the life of the machine.

The service life of these oil well bushings is, at present, not known; they have been in use only three to five years. Thus far there is no record of oil depletion or failure due to wear. Should the oil supply become exhausted, it can be replaced, though this requires returning the bushing to the factory for re-impregnation.

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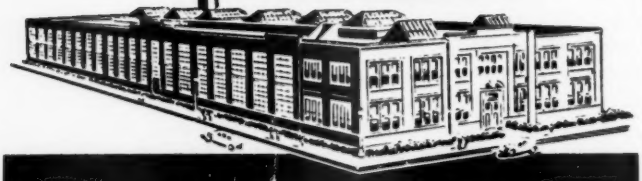

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DIE CASTINGS SAVE 60%
continued from page 43

The mounting pad for the coil, previously molded of plastic, is now formed as an integral part of the die casting, with a resultant saving in cost, inventory and assembling.

Flatness can be held close enough in the casting operation, and the mating surfaces between base and cover need no machining or grinding. Mounting surfaces now are cast as pads or short bosses, and the balance of the surface is relieved. This ability of the die casting process to place metal where it is needed and eliminate it where it isn't needed, has reduced the amount of metal required and yet has not affected strength or rigidity adversely. General wall thickness of the housing has been reduced, except for ribs to accom-

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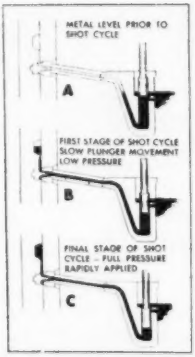
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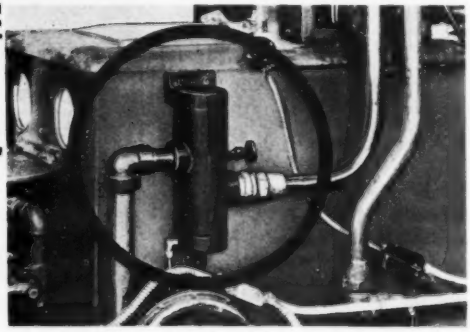

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modate mounting holes or to serve as ejector pads.

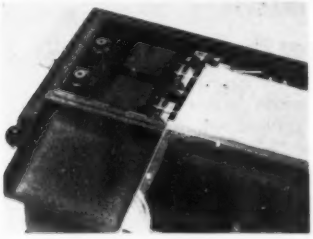
The present finishing cycle on the die cast zinc penmotor housing pieces, after the parts are received from the die caster, consist of a light tumbling, drilling with a single spindle press to remove flash from holes, drilling and tapping several small holes in one end.

The pieces are then given a zinc chromate primer for corrosion protection, baked 40 minutes at 300F, sprayed with a semi-gloss black enamel and again baked 40 minutes at 300F.

Large components are also suitable for die casting

So successful were the first die castings that study was undertaken toward the conversion of other components. Two side frames and the large base casting for the oscillograph appeared to promise similar benefits.

The side frames, for example, incorporate more than a dozen holes through which bearings and shafts for gears and rollers are supported. It is obvious that size and location of these holes are extremely important for the proper engagement of gears, the parallel relationship of rotating



INSTRUMENTS such as this double channel oscillograph are not large volume production units, but nevertheless, are economical for die casting.

shafts and the smooth feeding of the paper chart through the oscillograph.

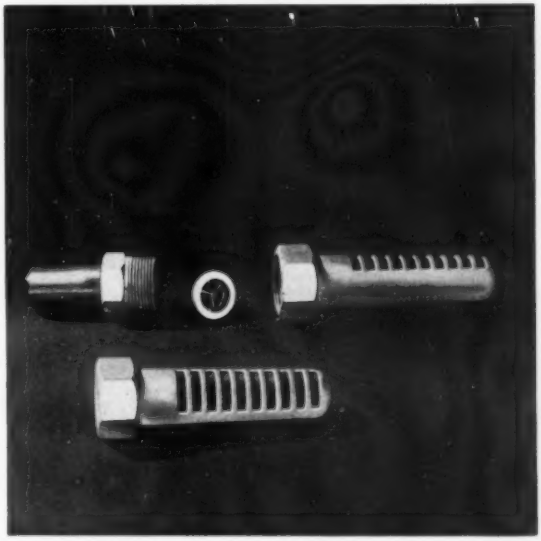
Flatness is required, along with freedom from warping or dimensional changes upon aging which might affect the alignment of shaft holes.

The die caster produces both the right and left side frames from the same cavity, thus assuring uniformity. One side has an extra bracket at its front edge and a removable plug in the die permits the casting of the side frame with or without this bracket, as desired.

All through holes are cored, and since the clamping and locating of the sand castings was previously one of the most harassing problems, the processing of these castings has been greatly simplified now. A series of small holes along the narrow edge of the castings still have to be drilled and tapped.

There has been a cost reduction of between 60 and 70 percent on the basis of finished piece costs by the change to die castings.

The base casting, also shown in Figure 3, was also a problem as a sand casting because of the difficulty in obtaining flat castings. These were often received in a bowed condition, and had



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to be milled across the entire bottom surface, after which the flanges and top surface were straddle milled.

The side frames are mounted on this base and rest against the flanges over a length of six inches at each side. In order to save a straddle milling operation, the die caster has been able to cast a portion of this flange with less than 1 degree of draft. This is sufficiently close to perpendicular to allow butting the side frames.

Generally, flatness is now held on the base casting, although manual straightening is sometimes necessary. Considerably less metal is needed than was previously required, and the amount of secondary processing is negligible.

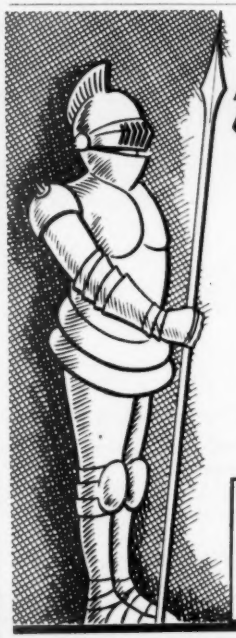
The over-all picture of die castings in the manufacturing operation of this major producer of recording instruments shows several distinct advantages.

- Simplification of production tooling;
- Lowering of finished piece costs by as much as 70 percent;
- Elimination of the majority of machining operations;
- Improvement in initial flatness, rigidity and parallel relationships.

INVESTMENT CASTINGS
continued from page 45

cleanliness of detail.

- Some weight reduction has been permitted because investment casting makes possible thinner, more uniform wall sections.
- The sand cast gun sights were difficult to assemble because each lead was held in position by an individual spring. The investment cast body makes possible a design change so that all three leaves can be held by one spring.



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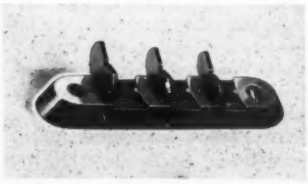
Part of the success of investment casting on large production quantities is due to the possibility of casting large numbers of pieces at one time. The leaves for this gunsight demonstrate this point.

A "tree" of castings is illustrated. A total of 72 leaf castings are cast at one time. The individual wax patterns for the



THIS GUNSIGHT SELLS FOR LESS because its housing and leaves are investment cast.

leaves are cast separately, and then mounted on a "tree" so that they can be invested, melted out and cast as a unit.

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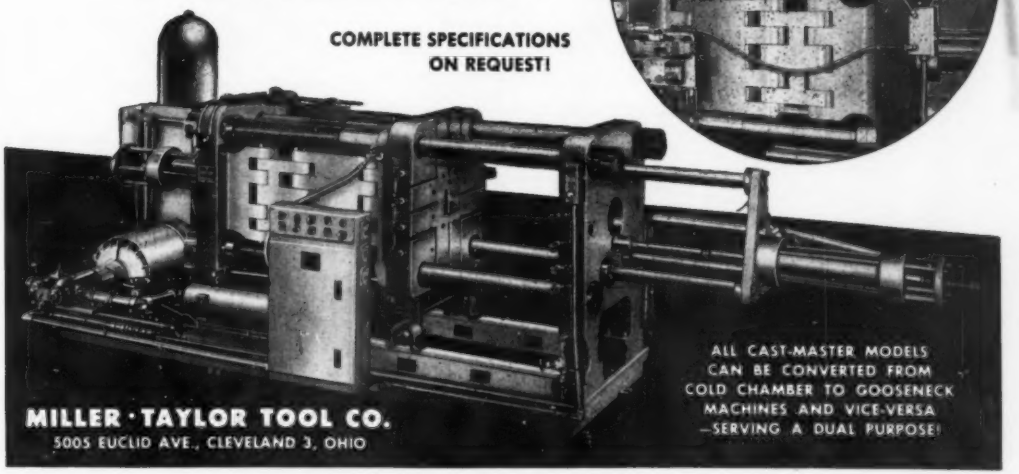

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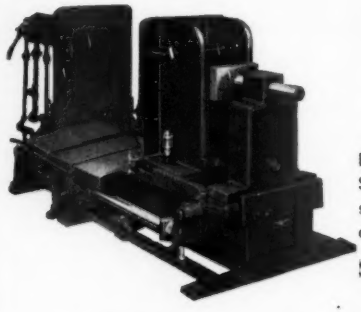
Of course, the "treeing" of patterns requires great skill so that the patterns will be properly positioned in relation to the flow of metal. This part of the operation determines not only the number of pieces per casting cycle, but also has an important influence on minimizing stresses and strains within the finished casting.

The fact that large volumes of ordnance parts are currently in production by investment casting demonstrates both the dollar-wisdom and the high quality casting results which are possible. Thousands of small parts which have conventionally been manufactured by sand casting, forging or standard machining methods can now be investment cast at or close to finished dimensions.



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NON-FLAMMABLE FLUID
continued from page 80

ed as thoroughly as practical before charging with Pydraul. As much as 5 to 10 percent of a standard fluid can remain in the system if necessary, but more than this will materially reduce the fire resistance. One thing to watch: because of its solvent action Pydraul will loosen and remove from the system accumulated carbon and other petroleum-base fluids deterioration products. If the system includes a filter the element should be checked frequently during the first few weeks of operation. Maintenance procedures otherwise, need not change.

How much will it cost? The initial cost will be higher ($3.75 a gallon compared with $.50 a gallon) than conventional fluids. But the cost of operation per hour, the company claims, should be equal to or less than other types of fluid.

A direct cost-per-gallon comparison of fluids, however, is not the whole story. Neither is a comparison of cost-per-hour of operation. For aside from dependability and longer pump and fluid life, increased safety offers intangible benefits in the form of higher employe morale and property protection, the value of which is incalculable.

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ELASTIC PROPERTIES
continued from page 48

the indicating controlled are produced by the Parker White-Metal Co. of Erie, Pa.

Brake drum and gear segment combined

Another unusual application of a zinc die casting is as a brake on the control pointer hand. The mounting element for the control pointer is a circular casting onto which is integrally cast a segment of a gear and a segment of a brake drum, as shown in Figure 1. The gear segment mates with a brass pinion gear and is used to set the control pointer.

Mounted on the same axis as the control and indicator hands is an arm carrying a mercury switch. A stop on this arm bears against the control hand and is spring loaded so as to tend to rotate in a counter-clockwise direction. In a clockwise direction, the arm is free to move. against spring tension, independently of the control pointer.

As the indicator arm moves in a clockwise direction with increasing temperature, it operates a micro switch when it reaches the control temperature. Provisions to prevent overshooting temperature are provided since the arm carrying the switch can move with the indicator hand. As the temperature drops, the indicator hand moves in a counter-clockwise direction and the switch arm follows it due to the spring loading. When the switch arm again contacts the control arm, it must stop and the control arm must resist further movement so that the temperature setting will not change.

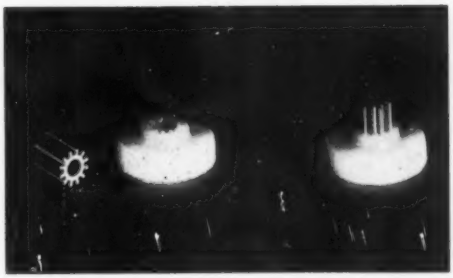
To prevent unwanted movement of the control hand. the brake mentioned above is provided. The zinc die casting carrying the brake drum segment is so mounted that a spring loaded brass brake band contacts the drum segment on the cast-

continued on page 111

SIMPLIFIFD SOLUTIONS

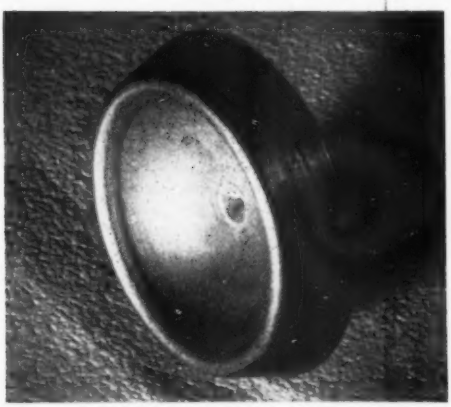
for production problems

AS AN ALUMINUM DIE CASTING this nut below needs only have the internal threads cut to ready it for use in washing machine assembly. The nut screws onto the gyrator drive shaft and the gyrator its-self is driven thru a fit on the truncated pyramid. Die casting produces a part of adequate strength, with good resistance to corrosion, at a marked saving in material and markedly lower in cost than a casting, forging or bar stock part.



FOR LONG LIFE and smooth, quiet operation a combination of powdered brass and nylon are used in this custer gear. above. The powdered brass pinion, made by the Merriman Bros., Co. of Boston, Mass. is pressed into the prefabricated nylon gear. Sufficient interference is allowed so that a permanently tight fit is secured. This assembly, in addition to smooth, quiet operation has a longer life and is less expensive to fabricate than when made by other manufacturing methods.

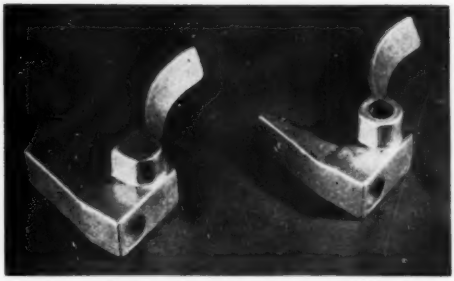
IN ORDER TO MAKE THE DIMPLES in egg crate separators the paper pulp must be formed while wet. Retention of shape is assured by removing much of the water content of the pulp during the forming operation. The powdered brass part shown, made by the Metal Powder Products, Inc., of Dayton, Ohio, is used for the job. After molding and sintering a plurality of holes is drilled so that adequate water removal from the pulp can be secured. The use of powder metallurgy as a fabricating method has resulted in a marked decrease in scrap in fabricating this part and a lower finished cost.



SIMPLIFIED SOLUTIONS

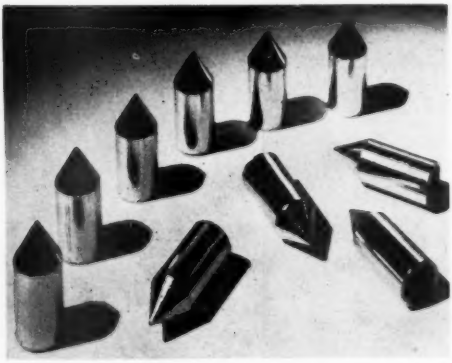
for production problems

PRODUCTION OF CAMS, particularly when large numbers of them are needed, involves the installation of very special and costly machines. Even with such machines the development of the camming surface may often require bench work with the inevitable variations associated with hand operations. The cam shown below is molded of iron powder by the Wel-Met Co., of Kent, Ohio. Each cam is an exact duplicate of every other one made on the same die. Production costs are lower than by any other method and the powder cam has the advantage of being self lubricating.



TO ACHIEVE A SMOOTH, READILY CLEANED SURFACE with a minimum of finishing operations, the Cherry Burrell Corp. uses plaster mold castings of nickel bronze made by the Universal Casting Corp., of Chicago, Ill. The part shown above, a cap clamp for a milk bottling machine, is cast to finished dimensions with one blind hole 5/16 diameter and 11/16 deep cored in. Finished by barrel polishing only two holes need to be drilled and one of them tapped to ready the clamp for installation on the capper. As cast piece is shown at left.

INCREASING COSTS FOR BRASS SCREW MACHINE PARTS have caused at least one manufacturer of archery equipment to convert to zinc die cast arrow points. The new points, below, functionally equal to the older brass ones, are now produced by Gries Reproducer Corp., of Brooklyn, N. Y. at only 50% of the cost of the screw machine part. The saving is due largely to reduced scrap loss.



ELASTIC PROPERTIES
continued from page 104

ing. By adjusting the spring tension under the band, the desired braking action of the control hand is secured. The assembly of this brake unit can be seen in the illustration of the instrument.

Other zinc die castings are used in the construction of the Partlow temperature controllers. These castings are used in what might be considered a more orthodox manner. The base casting has been designed so that all necessary support members and mounts can be cast without the use of slides or side cores. All small holes are drilled and, if necessary, tapped after casting.

Other than the case, which is also a die casting, two lever members are zinc castings. Both of these are quite simple parts and die casting is used only because of the lower cost as compared with other fabricating methods.

In connection with the levers, one point might be made. Any growth, upon aging, would, of course, be intolerable in connection with the lever mechanism of a temperature controller. Freedom from growth has been amply demonstrated by the long service these castings have had in the indicating controllers.

In general, the mechanical properties and physical constants of the zinc base die castings have been well suited to the demands of these control instruments, and the production method has proved to be economically sound for the quantities required. It might be pointed out in this connection that the design of products such as this temperature controller is relatively stable over a period of years, thus permitting the extended amortization of die costs.

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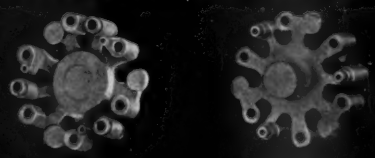

FRONT BACK

THE terminal insert illustrated is one of Arwood's outstanding achievements. It represented a real challenge to produce the die and to successfully cast the insert in bronze.

The insert was designed for investment casting and it is an application that is almost impossible to produce by conventional production methods.

Interesting to note are the six .070 diameter holes, the three .039 diameter holes and the .050 arms connecting the bosses to the hub —all cast to maximum tolerances of .002.

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MEETING PROGRAM FOR MPA SESSIONS

Subjects to be presented in papers before the eighth annual meeting of the Metal Powder Association in Chicago, April 29 and 30, are listed below.

- *Recent Practical Applications of Hot Pressing* Jerome F. Kuzmick, Welded Carbide Tool Co., Clifton, N. J.
- *Powder Metallurgy in the Manufacture of Clocks and Mechanisms*, F. Lux, Lux Clock Manufacturing Co., Waterbury, Conn.
- *Current Electronic Use by the Signal Corps of Magnetic Materials Produced by Powder Techniques*, E. Both, U. S. Signal Corps Laboratories, Fort Monmouth, N. J.
- *Aspects of Powder Metallurgy in National Defense*, John D. Dale, Frankford Arsenal, Philadelphia, Pa.
- *Powder Metallurgy in High Temperature Applications*, Julius J. Harwood, Office of Naval Research, Washington, D. C.

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  Hydrogen Reduced Iron Powder, R. H. Rodrian, C. K. Williams & Co.
  Electrolytic Iron Powder, W. M. Shafer, Plastic Metal Div., National Radiator Co.
  Moderator—W. E. Cairnes, Radio Cores, Inc.
- *Current Powder Metallurgy Developments in Europe*, W. D. Jones, consulting metallurgist, London, England.
- *The Use of Carbide Cores in Ordnance Applications*, Malcolm F. Judkins, Firth Sterling Steel and Carbide Co., McKeesport, Pa.

REFERENCE MATERIAL

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101. CLEANERS FOR METALS are the subject of literature from Cowles Chemical Co.

102. PREVENTION OF BLISTERING on plated zinc die castings by using an electrocleaner is covered in booklet from Diversey Corp.

103. SCREW THREAD INSERTS for use in die cast metals are the subject of data sheets from Groov-Pin.

104. CLEAR LACQUER produced by Maas & Waldstein is the subject of a technical bulletin.

105. CLEANING CASTINGS and other metal parts with a special compound is the subject of a booklet from Oakite Products.

106. BARREL FINISHING LAB for running trials and demonstrations on your castings is explained in a booklet from Roto-Finish Corp.

107. CRUSHERS, GRINDERS & SIFTERS for metal powders are covered in literature from Mercer-Robinson.

108. SILVERY-COLORED LUBRICANT for die casting dies is described in literature from E. F. Houghton.

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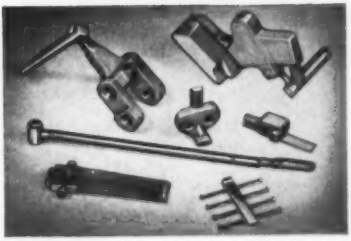

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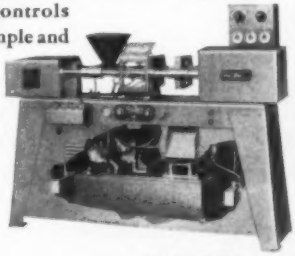

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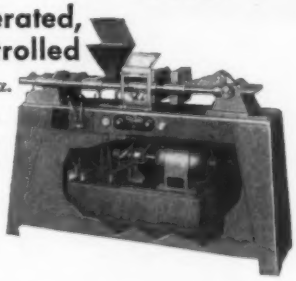

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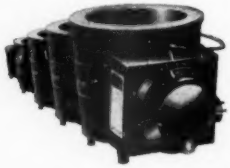

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PRECISION IN POWDERED METAL
continued from page 37

graphite brushes, sintered iron parts, refractory metal silver contacts, and various other types of materials get their properties from the processes through which they pass. The molding process in the field of powder metallurgy is the stage at which many of the final characteristics of the parts are determined. Thus, while dimensional tolerances are not particularly difficult on all of the items made by powder metallurgy, they are important on some, and this is in addition to the physical properties which must be held under control in part by the molding process.

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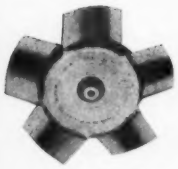

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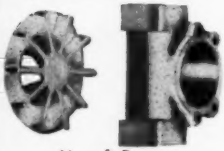

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● These die castings by PRESSURE, being used in the tank inter-communication system, have been submitted to the most trying conditions and have proven rugged as well as functional.

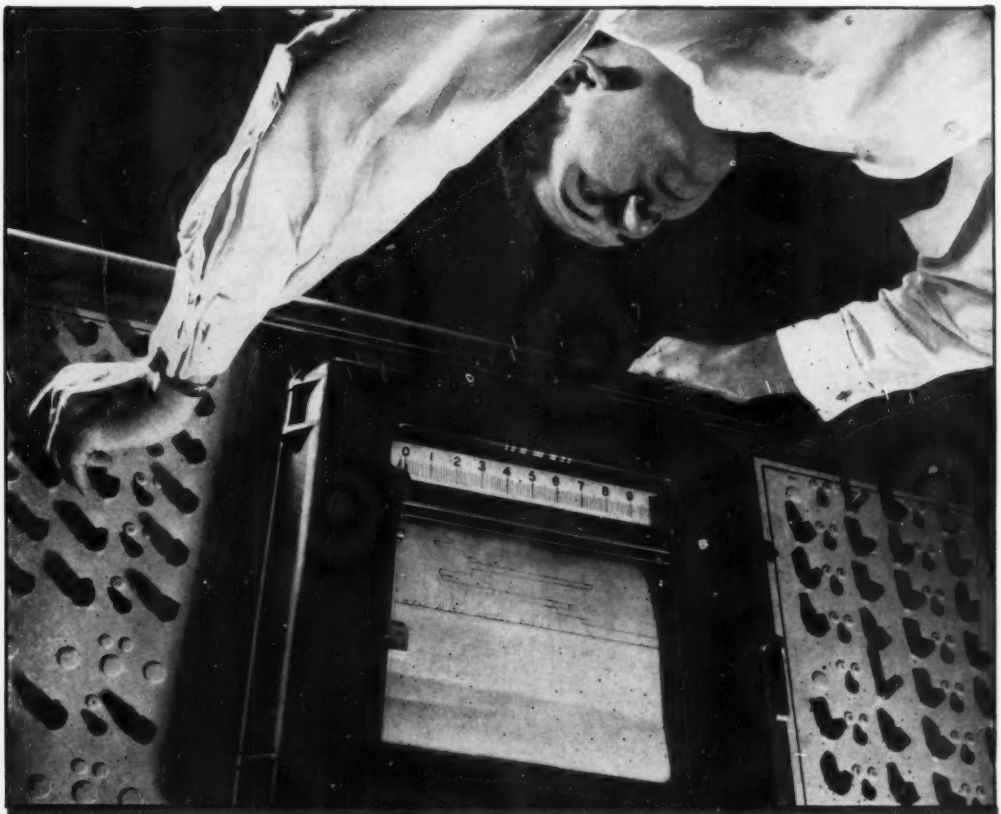
This is still another phase of the defense program in which die castings by PRESSURE play an important part.

We solicit your inquiries.

PRESSURE CASTINGS, INC.

die castings

CLEVELAND, OHIO



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ALUMICAST CORPORATION, 1523 N. Kilpatrick Avenue, Chicago 51, Illinois.

Illustrations above show the Quantometer which provides our laboratory technicians with a graphically recorded analysis of sixteen different elements—in less than three minutes. This ensures the correct casting alloy composition in every "heat". You benefit because of expert scientific control ("E.S.C.").

ALUMICAST

ALUMINUM and MAGNESIUM PERMANENT MOLD and DIE CASTINGS

"E.S.C." EXPERT SCIENTIFIC CONTROL

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